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Issued May 5, 1911.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—BULLETIN No. 78.
MILTON WHITNEY, Chief.

THE USE OF SOILS EAST OF THE GREAT PLAINS REGION.

BASED UPON THE WORK OF THE BUREAU OF SOILS TO JANUARY 1, 1910.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Soils,
Washington, D. C., December 23, 1910.

Sir: During the ten years' progress of the Soil Survey a total of 165,021 square miles, or 105,613,576 acres, have been mapped east of the Great Plains region on a scale of 1 inch to the mile. The areas have been distributed so that the work represents substantially every part of the country. A vast amount of information regarding the origin, properties, and use of the soils has been acquired and published in the annual reports of Field Operations of the Bureau of Soils. It has been thought advisable to bring this information together in the most compact form possible and in such a way as to bring out plainly the relationship and essential differences in the soils. This has been done in the present volume. As the work has progressed relationships have been seen in soils of different areas which could not have been foreseen until fuller information had been acquired, and to show these relationships clearly and to work out the genetic classification of the soils of the United States recorrelation or renaming of the soils of the several areas has been done when necessary. A complete list of these changes is given on pages 269 to 280, inclusive, enabling the tracing of any soil under the name as mapped to the present classification, which is essential to the systematic and progressive work of the bureau.

I recommend that this manuscript be published as Bulletin 78 of the Bureau of Soils.

Respectfully,

Milton Whitney,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

	Page.
The use of soils east of the Great Plains region	7
Introduction	7
Soils of the Atlantic and Gulf Coastal Plains province	15
The sand group	17
Loamy sand phase	21
The fine sand group	22
The sandy loam group	27
Coarse sandy loam phase	33
The fine sandy loam group	33
Very fine sandy phase	41
The loam group	42
The silt loam group	48
The clay loam group	53
Black clay loam phase	57
The clay group	57
Gravelly clay phase	62
Black clay phase	62
Soils of subordinate value	63
Gravels	63
Gravelly sandy loams	64
Stony sandy loam	66
Gravelly sand	67
Gravelly loams	67
Stony loam	68
Coarse sands	69
Miscellaneous materials	69
Summary	71
Soils of the Piedmont Plateau province	73
Soils of the Southern Piedmont Plateau	73
Dominant soils	76
Deeper soils differentiated by erosion	76
Shallow soils due to excessive erosion	78
Other Southern Piedmont soils	79
Soils of the Northern Piedmont Plateau	84
The sandy loam group	85
The fine sandy loam group	87
The loam group	87
Shale loam phase	88
The silt loam group	88
The clay loam group	89
The clay group	90
Other Northern Piedmont soils	90
Gravelly loam	90
Slate loam	90
Stony loams	91
Gravelly sandy loam	92
Nonproductive materials	92
Summary	93

The use of soils east of the Great Plains region—Continued. Page.
Soils of the Glacial and Loessial province ... 95
The sand group ... 97
The fine sand group ... 98
The sandy loam group ... 99
Coarse sandy loam phase ... 102
The fine sandy loam group ... 103
The loam group ... 104
The silt loam group ... 110
The clay loam group ... 117
Black clay loam phase ... 118
Soils of subordinate value ... 119
Coarse sand ... 119
Gravels ... 119
Gravelly sand ... 120
Stony sands ... 120
Gravelly sandy loams ... 121
Stony sandy loams ... 122
Gravelly loams ... 123
Stony loams ... 124
Slate loam ... 127
Miscellaneous materials ... 127
Summary ... 129
Soils of the Glacial Lake and River Terrace province ... 131
The sand group ... 132
Gravel phase ... 134
Gravelly sand phase ... 134
Coarse sand phase ... 135
The fine sand group ... 136
The sandy loam group ... 138
Gravelly sandy loam phase ... 142
Stony sandy loam phase ... 144
Coarse sandy loam phase ... 145
The fine sandy loam group ... 145
The loam group ... 148
Gravelly loam phase ... 153
Stony loam phase ... 155
Shale loam phase ... 156
The silt loam group ... 156
The clay loam group ... 159
The clay group ... 161
Black clay phase ... 164
Stony clay phase ... 164
Silty clay phase ... 165
Miscellaneous materials ... 165
Summary ... 167
Soils of the Limestone Valleys and Uplands province ... 169
The sandy loam group ... 170
The fine sandy loam group ... 170
The loam group ... 171
Gravelly loam phase ... 172
The silt loam group ... 173
Stony silt loam phase ... 175
The clay loam group ... 175

The use of soils east of the Great Plains region—Continued. Page.
Soils of the Limestone Valleys and Uplands province—Continued.
The clay group ... 178
Stony clay phase ... 179
Soils of subordinate value ... 179
Gravelly sandy loam ... 180
Stony loams ... 180
Miscellaneous materials ... 182
Summary ... 182
Soils of the Appalachian Mountain and Plateau province ... 183
The sandy loam group ... 184
The fine sandy loam group ... 185
The loam group ... 187
Black loam phase ... 189
Shale loam phase ... 190
The silt loam group ... 191
Stony silt loam phase ... 193
The clay loam group ... 194
The clay group ... 196
Soils of subordinate value ... 197
Sands ... 197
Stony sand ... 198
Stony sandy loams ... 198
Gravelly loams ... 199
Slate loam ... 200
Stony loams ... 200
Miscellaneous materials ... 203
Summary ... 204
Soils of the River Flood Plains province ... 207
The sand group ... 208
Coarse sand phase ... 210
The fine sand group ... 210
The sandy loam group ... 212
Gravelly sandy loam phase ... 216
Fine sandy loam group ... 217
The loam group ... 223
Gravelly loam phase ... 230
Shale loam phase ... 231
The silt loam group ... 232
The clay loam group ... 239
Silty clay loam phase ... 243
The clay group ... 244
Silty clay phase ... 248
Miscellaneous materials ... 250
Summary ... 251
Changes in classification involving change in soil name ... 253
List of changes in the correlation of soils ... 269
Index ... 281

ILLUSTRATIONS.

PLATE.

PLATE I.—Map showing soil provinces and areas surveyed..... In pocket.

FIGURES.

Page.

FIG. 1. Diagram showing classification of soil material according to mechanical analysis..... 13
2. Diagram showing the relative extent of the important groups of soils in the Atlantic and Gulf Coastal Plains province..... 17
3. Key to the soils of the Atlantic and Gulf Coastal Plains province..... 72
4. Diagram showing relative extent of the important groups of soils in the southern Piedmont Plateau province..... 74
5. Diagram showing relative extent of the important groups of soils in the northern Piedmont Plateau province..... 84
6. Key to the soils of the Piedmont Plateau province..... 92
7. Diagram showing the relative extent of the important groups of soils in the Glacial and Loessial province..... 95
8. Key to the soils of the Glacial and Loessial province..... 130
9. Diagram showing the relative extent of the important groups of soils in the Glacial Lake and River Terrace province..... 132
10. Key to the soils of the Glacial Lake and River Terrace province..... 168
11. Diagram showing the relative extent of the important groups of soils in the Limestone Valleys and Uplands province..... 169
12. Key to the soils of the Limestone Valleys and Uplands province..... 182
13. Diagram showing the relative extent of the important groups of soils in the Appalachian Mountain and Plateau province..... 183
14. Key to the soils of the Appalachian Mountain and Plateau province..... 206
15. Diagram showing the relative extent of the important groups of soils in the River Flood Plains province..... 208
16. Key to the soils of the River Flood Plains province..... 252

THE USE OF SOILS EAST OF THE GREAT PLAINS REGION.

INTRODUCTION.

The soil is the greatest of the material resources of the nation. It supplies a population of 90,000,000 people with most of their food and clothing, with much of the material for their houses and house furnishings, and with part of their fuel. In addition to this it produces a vast surplus of provisions and building materials for export to foreign countries. It provides the raw material for upward of 60 per cent of the gross value of all products of manufacture and the transportation lines with a large part of their tonnage.

An actual census is taken each ten years and an estimate made each year of the amount of about a dozen of our principal farm crops, but little definite is known about the production of the subordinate farm crops or the important fruit and vegetable crops, as it has been found impracticable to obtain statistics upon which to base reliable estimates.

Of the crops adapted for human food we have reliable statistics of wheat, potatoes, rice, sugar, corn, and oats; for animal food, corn, oats, and hay; for clothing, cotton; for the manufacture of malt and spirituous liquors, barley, hops, corn, and rye; for chewing and smoking, tobacco; and for heat and habitation, forest products. The estimated farm value of these and other farm crops not specified, exclusive of the forest products, was for the year 1909 $5,760,000,000. The cost to the consumer was, of course, much more. And enormous as this total is, it does not include the value of vegetables and fruits.

The principal articles of human foods may be arranged under four groups: (1) Meats, (2) dairy products, (3) flour, meal, rice, sugar, and molasses, and (4) vegetables and fruits. Of these it is estimated that the meats cost the family about two-fifths of the whole and the other groups about one-fifth each. This would make the total cost of the vegetables and fruits for our people something over $1,000,000,000, or a sum at least approximating this figure. As a great part of the vegetable and fruit crop that matures during the summer is perishable and will keep only a few days, it has to be marketed and consumed at once; there is little chance to bring great quantities of it together, as can be done with the grain crops, and so the real magnitude of these products of the soil has never been appreciated. It may

be a matter of some surprise in reading the description of the soils which follow to see that the use of the various soils for fruit and vegetables is considered of quite as much importance as their use for what are called general farm crops and for dairying, but it is believed that this is justified for the present and will be of more importance in the future, as the tendency seems to be toward an increased use of vegetables and fruits in this country, with a corresponding decrease in the use of meats. As a nation we consume much more meat per capita than do the people of Europe.

The purpose of this bulletin is to indicate the proper use of soils in the production of the several staple farm crops, dairy products, fruits, and vegetables. It is impossible within the limits of the bulletin to discuss all details—for example, the use of each soil for different varieties of each crop, the best order for crops to follow each other on each soil, or the question of soil treatment or fertilization. In a general way the peculiarities of the several soil provinces are pointed out and the peculiarities of different soil types explained. With the grouping that has been given the reason why any particular soil does not conform to the group adaptation for crops is generally apparent from the description, and the means to be taken to alter the soil condition is usually clearly seen. It is generally inadvisable to attempt to alter a soil so far as to permit of a heavier type of agriculture than indicated for the group to which the soil belongs in the present arrangement. Much can be done by improved methods to increase the crop yields and general soil efficiency, but this had best be done with the group limitations in mind.

The profitable use of soils is determined in part by market and transportation facilities, by geographical and topographical position, and by erosion, as well as in part by the past usage of the land, but these are matters of local concern for the individual owner. In other words, it is impossible to say what is the best use of the soil of a particular farm or field without considering these other factors in addition to the general adaptation of the soil as a member of a group. Still it is important to recognize the best use of soils in case conditions are or will become favorable to the development of their highest possible efficiency.

The period has passed when general or pioneer methods of agriculture will either satisfy our people or sustain for much longer our ever-increasing population. The West has finally been settled in outline and our lands are practically under occupation for agricultural use, and this has been accomplished at great expense to the Eastern States in the loss of rural population, especially of the young people, and in the depreciation of land values due largely to sentiment and an impression that the great opportunities lie in the West.

Whatever may have been, at the present time and as far as can be seen in the future, the great opportunities in the eastern half of the United States are in the East, where much cheap land near the great cities can be obtained with a very large demand for special and perishable products. The time is at hand, therefore, when the Eastern States should be resettled under a more stable and more intensive system of agriculture than has prevailed in the past. This movement toward more intensive systems of agriculture will, on account of markets and transportation facilities, start in the East and South and spread West as population and the needs of our people increase.

In any organized and specialized business, in any line of development in which capital, as such, can safely be invested there are two fundamental requirements—that the material, in this case the soil, be understood, and that labor understand and can handle the material intelligently under directive control, so that the products of material and labor be certain. To fulfill these conditions in our agricultural development the material, the soil, must be understood and organized with respect to its productive capacity and the crops for which it may best be used; and when so used it should be handled with skill and judgment with suitable equipment to develop and maintain its highest efficiency. These matters are discussed in connection with the several groups of soil and soil provinces.

The soils of the eastern half of the United States, of which we are treating specifically, and of which the bureau has surveyed an area of 105,613,576 acres, arrange themselves in five great provinces, in each of which the material has a common origin or a common mode of formation.

The soils of the Piedmont Plateau province, of which 10,306,426 acres have been surveyed, are derived directly from the disintegration of old crystalline and metamorphic rocks, and as there has been but little opportunity of shifting or assorting the material, the soil types depend, to a very large extent, upon the character of the original rock mass. For this reason there is not a great complexity in the soils of this province, some of the differences being due mainly to local erosion.

The soils of the Atlantic and Gulf Coastal Plains province, of which 32,576,360 acres have been surveyed, have been formed in large part from the material brought down by the rivers from the Piedmont Plateau, the Appalachian Mountains and Plateaus, and from the glaciated regions farther north, and were at some former period submerged below the ocean level and subjected to wave and tidal action. This has resulted in a high degree of assortment of the mineral particles and the multiplication of soil types, which range from the coarsest gravels and sands to the finest silts and clays.

The soils of the River Flood Plains province, of which 12,756,177 acres have been surveyed, consist of material brought down within

comparatively recent periods by streams from the Piedmont Plateau, the Appalachian Mountains and Plateaus, the glaciated regions, and the Coastal Plain itself, which material in its progress toward the ocean (considering only the finer grades of material) gives us soils that are still forming or, having been formed, are young and generally more productive than the areas from which the material was derived.

The soils of the Glacial and Loessial province, of which 24,562,696 acres have been surveyed, have been derived from a heterogeneous mass of rocks of all kinds, which have been brought together from all sources, frequently from great distances, and ground up by the moving ice and glacial waters. A remarkably uniform consistency and color have resulted—a color that is modified only in the northeast part of the province, where the glaciation has been superficial and the country rocks have contributed sensibly to the character of the present soil material. Soils formed through this agency have characteristic properties, which, in the main, are unlike the properties of soils of similar texture found in any other soil province.

The soils of the Glacial Lake and River Terrace province, of which 7,586,286 acres have been surveyed, consist of the same glaciated material as the Glacial and Loessial province soils, but the material has been transported and reworked by rivers and subjected particularly to the subsequent wave action of the old glacial lakes. This has differentiated and segregated the different grades of material to such an extent as to give the long list of soil types ranging from the coarsest gravels and sands to the finest silts and clays found in this province. A degree of specialization in agriculture is therefore practicable here, which is hardly possible in the Glacial and Loessial region from which the material has been derived.

The soils of the Limestone Valleys and Uplands province, of which 7,666,814 acres have been surveyed, consist of material left after the solution and subsequent leaching of the lime from the limestone rock, and are, in fact, composed of the impurities and the less soluble portion of the original rock. These soils, being formed in place without subsequent transportation or mixing, partake of the nature of the original limestone rock or the interbedded shales and sandstones. This rock gives on the whole a rather uniform group of soils adapted to a heavy type of agriculture.

The soils of the Appalachian Mountains and Plateau province, of which 10,158,817 acres have been surveyed, are derived from the disintegration in place of the old sandstone and shales more resistant to weathering influences than the limestone. They occur usually as high plateaus or mountain ranges, the soils being differentiated mainly by the distribution of the rock, but in part by the weathering agencies to which the rocks have been subjected and in part to the resistance of the rock material to such weathering. The soils of this

province do not, as a rule, compare favorably with the soils of any of the other provinces, so far as agricultural value or crop adaptation is concerned.

In any one of these provinces will be found soils derived from the same kind of material, formed through the same agencies, and having certain physical and chemical characters in common, but differing texturally. Such differences in the proportions of the several grades of material or size of the mineral particles give rise to the various soil types. Where such material presents itself as a sand, sandy loam, silt loam, clay loam, clay, and other recognized soil type it constitutes a series and is given a common name. We have, for example, in the Atlantic and Gulf Coastal Plains province the Orangeburg series, which has a red sandy clay subsoil and, in the lighter types, a gray surface soil, characteristics at once determining the series within the province. This series contains as types the Orangeburg sand, Orangeburg fine sand, Orangeburg sandy loam, Orangeburg fine sandy loam, and Orangeburg clay. It is thus an incomplete series, as there are other grades—for example, the loam, silt loam, and clay loam—which it is reasonable to expect will be encountered in some subsequent surveys. The material of the Orangeburg series has a common origin and, except for the difference in texture, it has certain well-marked peculiarities, both in its physical aspect, which distinguishes it from all other soils in appearance, and in its agricultural value and crop adaptation, which, type for type, are distinct from those of every other soil. Within itself, however, it differs only in texture, ranging from sand to clay, with omission of certain of the intermediate classes, as already indicated.

Bulletin 55 of this bureau, entitled Soils of the United States, based upon the work of the Bureau of Soils to January 1, 1908, treats of the relationship of soils with particular reference to the different members of the soil series. In the present bulletin the arrangement is different and is based upon certain groupings arranged to bring out best the uses to which the soils are adapted and the principal requirements or the treatment necessary to adapt the individual groups for their best use.

The important groups, so far as agricultural development is concerned, are eight, viz, sands, fine sands, sandy loams, fine sandy loams, loams, silt loams, clay loams, and clays. There are phases of these groups, as gravelly sands, loamy sands, stony loams, and stony clays, which may, in certain provinces, be included in the group and in other provinces be set aside as subordinate soils of little agricultural value.

Table I, based upon the mechanical analyses of 8,664 samples, gives an idea of the average mechanical composition of the soils of different groups, or, in other words, the relative proportions of different grades of material entering into the composition of soils.

TABLE I.—*Average composition of soil material as analyzed in connection with the soil surveys.*

Soil class.	No. of samples.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Coarse sands	135	12	31	19	20	6	7	5
Sands	401	2	15	23	37	11	7	5
Fine sands	511	1	4	10	57	17	7	4
Sandy loams	1141	4	13	12	25	13	21	12
Fine sandy loams	934	1	3	4	32	24	24	12
Loams	659	2	5	5	15	17	40	16
Silt loams	1268	1	2	1	5	11	65	15
Sandy clays	162	2	8	8	30	12	13	27
Clay loams	718	1	4	4	14	13	38	26
Silty clay loams	765	0	2	1	4	7	61	25
Clay	1970	1	3	2	8	8	36	42

By plotting the results of these mechanical analyses a diagram (figure 1) has been prepared showing the field occupied by each of the principal grades of material. From this diagram and from interpolations in the case of the sands and sandy loams the following table has been prepared, giving the limiting values for each important grade of material, excluding gravel, stones, and fragments of rock that do not pass through a 2-millimeter sieve.

Classification of soil material.

Soils containing —20 silt and clay:

- Coarse sand: 25+ fine gravel and coarse sand. and less than 50 any other grade.
- Sand: 25+ fine gravel, coarse and medium sand, and less than 50 fine sand.
- Fine sand: 50+ fine sand, or —25 fine gravel, coarse and medium sand.
- Very fine sand: 50+ very fine sand.

Soils containing 20–50 silt and clay:

- Sandy loam: 25+ fine gravel, coarse and medium sand.
- Fine sandy loam: 50+ fine sand, or —25 fine gravel, coarse and medium sand.
- Sandy clay: —20 silt.

Soils containing 50+ silt and clay:

- Loam: —20 clay, —50 silt.
- Silt loam: —20 clay, 50+ silt.
- Clay loam: 20–30 clay, —50 silt.
- Silty clay loam: 20–30 clay, 50+ silt.
- Clay: 30+ clay.

NOTE.—The figures represent per cent; the minus sign (—) and the plus sign (+) represent less or more; and the sign (–) when used between two figures, thus, 20–50, give limiting values, and should be read from 20 per cent to 50 per cent.

Most of our soils are not uniform in texture. Within a 3-foot section it is a usual thing in the eastern United States to find the subsoil heavier in texture than the soil; that is, containing more of the finer grades of material than does the surface soil, but this is brought out in every case in the descriptions of the different types, where the character and texture of the surface soil and subsoil are both described. It is not unusual, therefore, for a sandy loam to be described as having a clay subsoil, or a clay soil in an undisturbed

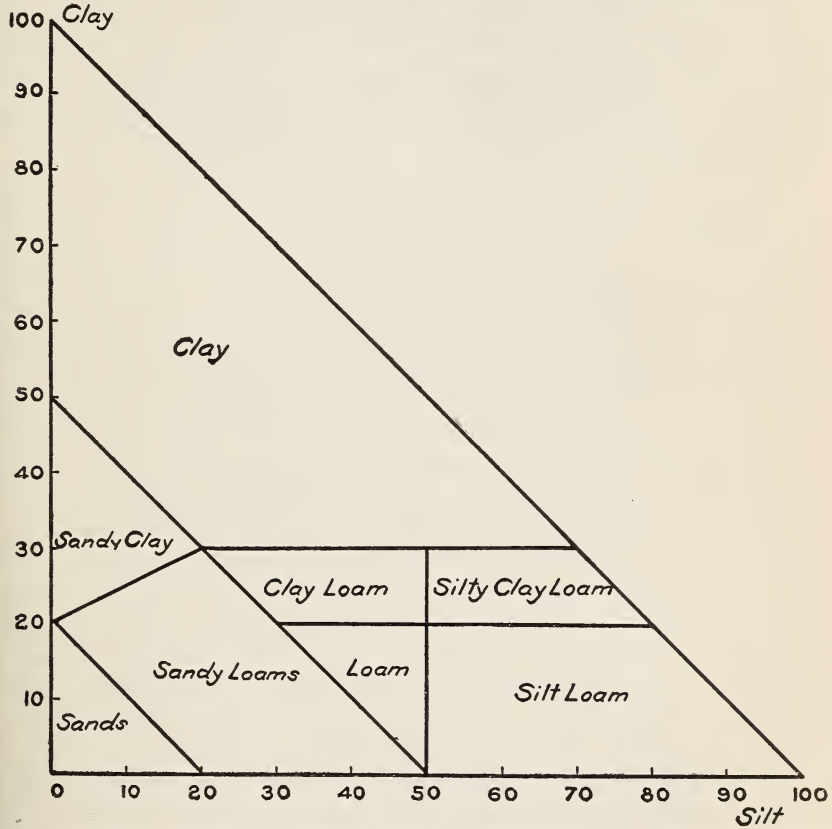


FIG. 1.—Diagram showing classification of soil material according to mechanical analysis.

state as having 2 or 3 inches of a sandy covering. In the detailed reports of any particular area variations in both soil and subsoil are frequently described. These departures from type are usually insufficient to warrant mapping as another type of soil and can not be considered in the brief general descriptions that have been adopted for the purposes of the present bulletin.

The first four groups in the above table—that is, the sands, fine sands, sandy loams, and fine sandy loams—are generally referred to

as light soils, and the other four groups, loams to clays, exclusive of the sandy clays, inclusive, are referred to as heavy soils. In this use the words "light" and "heavy" refer not to the weight of the cubic foot of soil, but to the draft required in plowing or otherwise handling the soil. On account of the fineness of the material and the forces that are brought to bear in holding fine material of this kind together into a plastic or coherent condition, it requires much more power to plow, cultivate, or carry on other farming operations on the loam and clay groups than it does on the loose or only slightly coherent soils of the sandy groups. Furthermore, the yields are generally larger and the products are more bulky on the loam and clay groups than on the sandy groups, and this requires heavier teams for harvesting the crops as well as larger and more substantial buildings for storage purposes and better farm equipment.

SOILS OF THE ATLANTIC AND GULF COASTAL PLAINS PROVINCE.

The soil survey has completed the mapping of 32,576,360 acres in the Atlantic and Gulf Coastal Plains. This is about 14 per cent or one-seventh of the total estimated area of the province. The work has been so distributed, it is believed, that the results are fairly representative of the soil resources of the entire province.

The soils of this province are highly differentiated and preeminently special-purpose soils adapted in general to highly specialized industries requiring the most intensive and expensive methods of cultivation. For the most part the soils are light in texture and admirably adapted to early spring vegetables of various sorts. They extend through a range of climate from the subtropical immediately along the Gulf coast to that of the latitude of New York, and have the advantage, at least when trucking is concerned, of low elevation and a nearly level surface. They are likewise favored in their proximity to the ocean and Gulf, which insures a warmer and more equable winter and spring climate than is found in other parts of the eastern half of the United States. For these reasons they have a monopoly of the markets of a very large part of the country for fresh vegetables and fruits for six months of the year or from about January 1 to July 1. On account of the great range in latitude—over a thousand miles in actual distance—and the rather slow advance of spring northward, as well as the difference in time of maturity of crops on the different grades of soil, as indicated in subsequent pages, a constant daily supply of fresh perishable vegetables and fruits is poured into the northern markets during the first half of the year. After this period the season has advanced to a point where the supply is drawn in a similar progressive manner from the various types of soil mainly of the Glacial soil provinces.

An idea of this progressive movement of the sources of supply of vegetables due both to the advance of the season from south to north and to the influence of soil texture is given in Table II.

TABLE II.—*Market periods for fresh vegetables for the six months, January to June, and the relative order of the supply from localities and from different types of soil in each locality.*

Locality.	First period.	Second period.	Third period.	Fourth period.	Fifth period.	Sixth period.
Long Island						Sand.
Maryland and Delaware					Sand	Fine sand.
Virginia				Sand	Fine sand	Sandy loam.
North Carolina			Sand	Fine sand	Sandy loam.	Fine sandy loam.
South Carolina		Sand	Fine sand	Sandy loam.	Fine sandy loam.	Loam.
Georgia and Florida	Sand.	Fine sand.	Sandy loam.	Fine sandy loam.	Loam	Silt loam.

Each of the localities named can in normal seasons count on from two to three weeks advance in crop maturity over the locality north, and this is the period in which they can market their crops at the greatest profit. Furthermore, there is about the same interval of two or three weeks in the time of maturity of crops on the several grades of soil. The very earliest crops of vegetables come from the light, porous, well-drained, warm, dry sands. The yields from such very early soils are light; the quality of the vegetables is not, as a rule, the best; they are very perishable and do not stand transportation well. They usually bring high prices, however, because of the great demand and the limited supply on the markets.

The crop from the fine sand maturing about two weeks later gives a larger yield of better quality in every way, which compensates for the lower market price and for the competition from the more sandy soils of the next northern locality. Georgia, for example, can not compete in the northern markets with truck grown on her heavier soils, simply because at the time it matures there is such a wide range of soils in more northern localities rushing vegetables over an ever-decreasing length of haul to the great markets.

The conditions with respect to the soils of Texas and Louisiana are somewhat different in that they can continue for a longer time to supply the great markets of the Middle West, including Chicago, St. Louis, Kansas City, Omaha, St. Paul, and Minneapolis, as there is less competition from more northern localities, and of soil types a wider textural range can be used for early vegetables than can profitably be used in the more eastern and northern parts of the province.

While the general character of the soils of this province, their variation, and extent north and south adapt them, as has been said, preeminently to early trucking and fruit industries, they also have

an important place in general agriculture, particularly in the production of cotton, sugar cane, rice, tobacco, and corn.

Figure 2 shows diagrammatically the relative extent of the several important groups of soil in the province. It will be seen from this diagram that the dominant groups are the lighter soils, requiring rather light farm equipment, but with a fair proportion of loams, silt loams, and clays, which require a much heavier equipment to bring out their highest efficiency.

With this general explanation of conditions affecting the use of soils of the province, a more or less detailed description of the soils will be taken up. The treatment of the subject will be by groups of soils of similar texture, giving first in general terms the use of the group and then the departures of the individual types in the group,

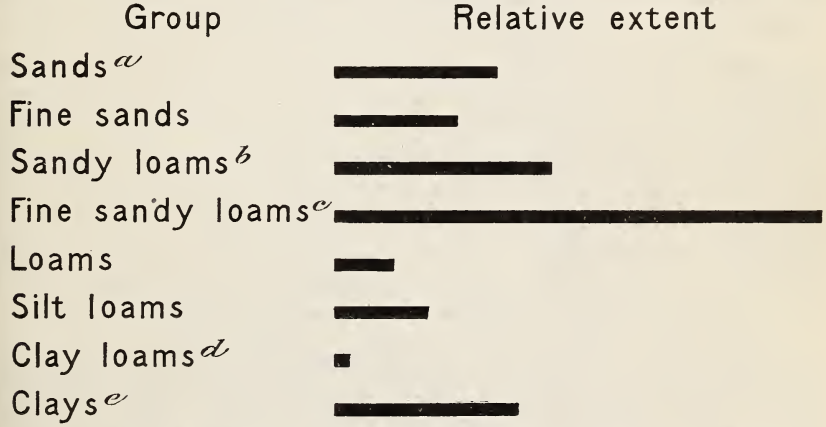


FIG. 2.—Diagram showing the relative extent of the important groups of soils in the Atlantic and Gulf Coastal Plains province. [a] Including the loamy sand phase. [b] Including the coarse sandy loam phase. [c] Including the very fine sandy loam phase. [d] Including the black clay loam phase. [e] Including the gravelly clay and black clay phases.

noting so far as practicable the reasons for this departure from the use to be naturally expected in soils of such texture and position in the soil classification.

THE SAND GROUP.

The deep medium-textured sandy lands of the Atlantic and Gulf Coastal Plains, which are characterized by their open structure, thorough drainage, and consequent warm nature, constitute the earliest truck soils of the region. Invariably they should be selected for growing vegetables for the *earliest markets*. The yields on these deep sands are rather light and the keeping quality of the products is not as good as in case of those grown upon some of the associated finer-textured soils. For example, the earliest Irish potatoes coming from the deep sands are small and very perishable.

The soils are not adapted to general farming. They are preeminently the early truck soils and their most profitable use lies in the production of high-priced crops for the earliest local and distant markets accessible by rapid transportation.

TABLE III.—*Area and distribution of the sands.*

Name of soil.	State and area.[1]	Acres.
Norfolk sand	Ala. 2, 5, 8, 11, 15, 20, 21, 23, 24, 26; Del. 1; Fla. 1, 2, 3, 4, 5, 6; Ga. 1, 4, 5, 7, 8, 11, 12, 13; La. 2, 11, 12; Md. 1, 2, 8, 10; Miss. 1, 6, 13; N. J. 2; N. C. 8, 15, 17, 18, 19; S. C. 4, 6, 7, 8, 9, 11, 12, 13; Tex. 1, 12, 21, 22, 27; Va. 5.	2,542,412
Orangeburg sand	Ala. 1, 2, 5, 8, 15, 24, 26; Fla. 1, 2, 4, 5; Ga. 1; La. 12; Miss. 6; S. C. 7, 9, 11, 13; Tex. 9, 21.	350,752
Sassafras sand	Md. 1, 3, 4, 5, 6, 9; N. J. 1; N. Y. 6	337,346
Portsmouth sand	Ala. 2; Del. 1; Fla. 1, 2; Ga. 1, 12; Md. 10; N. C. 6, 7; S. C. 6; Va. 10.	154,432
Lufkin sand	Tex. 16	63,936
Leon sand	Fla. 5	61,376
Gadsden sand	Fla. 2, 4, 5; Ga. 1	54,784
Gainesville sand	Fla. 3	7,744
Durant sand	Okla. 2	4,288
Tifton sand	Ga. 12	1,664
Susquehanna sand	Md. 1	1,600
Collington sand	Md. 1	1,216
Ruston sand	La. 8	1,024

[1] For key to numbers in this column, see p. 253.

Norfolk sand.—This soil is a coarse to medium, incoherent, gray or yellowish sand, resting on a yellow sand subsoil of about the same texture, and extending to a depth of 3 feet or more. This is a common type on the low, flat river necks and forelands of the Atlantic and Gulf Coastal Plains, along the valley slopes of the streams, and covering extensive level areas in the uplands. These different positions have a marked influence upon its productiveness, the upland areas giving the lowest yields. The soil is well drained, matures crops very early, and has such a poor water-retaining power that general farm crops can not be grown with any great success, except upon the low-lying areas, where the water table comes within a few feet of the surface. It is a good early truck soil, especially adapted to light truck crops. It is also used for small fruits and peaches, although not so well adapted to these latter as some of the other soils of the series. Many watermelons are grown upon this soil in the Southern States. In Florida a very fine grade, though small yield, of cigar-wrapper tobacco is produced. In Maryland it produces a fine grade of Maryland export tobacco. In North and South Carolina it produces a very fine grade of cigarette tobacco, but is not as well adapted to this crop as is the Norfolk sandy loam and fine sandy loam, as the yield is less. The river-neck and foreland de-

velopment of the soil is the best for truck crops and the upland best for tobacco.

Orangeburg sand.—This type consists of a gray sand, of medium texture, from 6 to 8 inches deep, resting upon a reddish-yellow sandy subsoil, which in turn is underlain at a depth of from 15 to 36 inches by a red sandy clay. The soil usually contains some iron concretions, and usually occupies gently rolling areas and has good natural drainage. It gives poor yields of corn and cotton, but is well adapted to early truck, peaches, and wrapper tobacco.

Sassafras sand.—The soil is a coarse to medium textured sand, of dull-brown color, and varying from 5 to 10 inches in depth. The subsoil is a reddish-yellow and sometimes an orange-yellow sand, which becomes slightly loamy and coarser with increase in depth. Its surface features vary from flat forelands, nearly on a level with tide-water, to slopes and low knolls and ridges in the uplands. It is a light, well-drained soil and naturally warm and well adapted to vegetables, especially the early market-garden varieties. It is also suited for use in growing tomatoes, asparagus, and sweet and Irish potatoes. It is an excellent type for growing cowpeas for seed.

Portsmouth sand.—This soil is a black, brown, or dark-gray loamy sand, about 12 inches deep, usually containing a large amount of organic matter. The subsoil is a gray or mottled drab, white, and yellow sticky sand, underlain at from 24 to 48 inches by a compact and rather impervious stratum of sand having the properties of a hardpan. Occasionally the subsoil is so saturated with water as to resemble quicksand. This type occurs in nearly level upland areas with poor drainage and represents former lake and swamp areas. Corn is the principal crop at present. The type is adapted to berries, particularly to strawberries, and to cabbage, onions, and other heavy or late truck crops. It is much later in maturing crops, but when well drained gives larger yields than the other soils of this group on account of the large amount of organic matter and the correspondingly greater water-holding capacity.

Lufkin sand.—This type consists of a loose, incoherent gray to brown medium sand, 12 inches in depth, underlain by a gray or yellow sand of the same texture. Beneath the sand, at a depth of 2½ to 5 feet, is found the same drab and yellow mottled sandy clay that forms the subsoil of the Lufkin sandy loam, the only distinction between the two types being the difference in the depth of sand overlying the clay and the consequent difference in agricultural value. The soil readily absorbs water, and its location on ridges or in proximity to streams insures adequate drainage. The soil is rather poor and leachy, and crops grown upon it usually suffer from lack of moisture. It is well suited to sweet potatoes, and under intensive methods, with plenty of manure, to other early truck crops. It

supports a forest growth of post oak, black-jack oak, and some live oak.

Leon sand.—From 6 to 10 inches the soil is a light-gray or white medium sand, occasionally containing sufficient organic matter to give it a dark-gray color. The subsoil is a compact medium white sand, usually saturated with water. The type has an almost level surface and is deficient in natural drainage. It supports a timber growth of longleaf pine and an undergrowth of wire-grass and dwarf palmetto. No areas under cultivation have been encountered, as it requires rather extensive and costly work for reclamation.

Gadsden sand.—The type consists of a dark-gray sand 10 inches deep, underlain by a gray or brownish sand, appearing lighter in texture, and extending to a depth of more than 36 inches. The soil is of medium to fine texture, and there is usually a considerable admixture of organic matter. The type occupies gentle slopes or undulations adjacent to streams, and is mainly hammock land supporting a growth of hardwood forests. It is one of the best soils for the Florida wrapper tobacco, but requires careful treatment to maintain the yields. It is the most productive soil in this group and is admirably adapted to truck for the early markets.

Gainesville sand.—This soil is a gray loamy sand, 8 inches deep, containing much organic matter, and underlain by a brown loamy sand of looser structure. The subsoil varies in depth, but is usually underlain at less than 3 feet by a calcareous clay or by partly weathered limestone. Both soil and subsoil contain limestone fragments. The type occupies high, rolling uplands, and the drainage is good. It retains moisture only fairly well, and crops suffer seriously during droughts. The characteristic vegetation is mixed forest of pine and hardwoods. The principal crop is Sea Island cotton, for which the soil seems especially well adapted. The soil should be used for early vegetables. It is also used for corn, oats, and peanuts, of which light yields are obtained.

Durant sand.—This soil has a depth of from 26 to 30 inches and consists mainly of a medium to fine sand, with only a small percentage of the coarser grades of sand and of clay. The upper 6 inches is darkened by a small proportion of organic matter, but below this the sand is white or yellow in color and lacking in humus. The subsoil to a depth of more than 3 feet consists of a yellow very sandy loam made up of the medium and fine grades of sand and from 10 to 20 per cent of clay. The type occupies gently to roughly rolling areas and owes its origin to the weathering of the Silo sandstone. Cotton and corn are the only crops which have been grown upon it. Owing to the light texture of the soil the yields are light. It should be used for the production of early truck crops when transportation facilities and market demands warrant.

Tifton sand.—This soil consists of a medium to coarse sand about 10 inches in depth, gray at the surface and yellow below. The subsoil is an ocherous-yellow to reddish-yellow coarse sandy loam of rather open structure. It occupies the higher elevations usually surrounded by areas of Tifton sandy loam, and is little cultivated. It contains many iron concretions.

Susquehanna sand.—The soil to a depth of 6 or 8 inches is a pale reddish-yellow to pink loose sand. The subsoil is a light-red or pink mealy sand which usually becomes sticky and grayish-scarlet and pink, between 20 to 36 inches. Stiff mottled clay, corresponding to the Susquehanna clay material, is encountered ordinarily anywhere from 20 inches to 4 or 5 feet below the surface. The type occurs mainly as caps of low hills. It is fairly well adapted to vegetables and, in Texas, peaches for the early markets.

Collington sand.—The soil is a yellowish-gray to reddish-gray rather coarse sand from 10 to 20 inches deep. The subsoil, a greenish-yellow loamy sand, is underlain at a depth of about 3 feet by a rather stiff olive-colored sandy loam or sandy clay. Glauconite sand is found in both soil and subsoil. Being almost always underlain by clayey material at from 36 to 40 inches, the soil is fairly retentive of moisture, particularly when liberally supplied with organic matter. It occurs as almost flat areas at low elevations. Watermelons, cantaloupes, small fruits, early peaches, and a number of vegetables do extremely well for the early market varieties. The Maryland type of tobacco has excellent quality when grown on this soil.

Ruston sand.—The type consists of a light-gray, loose-textured, medium sand, varying from 8 to 24 inches in depth, underlain by a dingy, yellowish-red loamy sand, which becomes heavier with depth, and is a sticky, sandy clay at 36 inches. The type occupies high ridges, and good drainage is secured by the natural porosity of the material combined with the rolling topography. It is somewhat leachy, and crop yields are apt to decline under present methods of management. It gives small yields of cotton, but is better adapted to early vegetables.

LOAMY SAND PHASE.

The soils of this class differ but little from those of the last-named group, but because of the loamy character they are, as a class, slightly more productive and easier to maintain in a high degree of efficiency than are the more incoherent soils of the group. They constitute more properly a subgroup or phase of the sand group than a separate group of soils.

TABLE IV.—*Area and distribution of the loamy sands.*

Name of soil.	State and area.[1]	Acres.
Norfolk loamy sand	Ala. 12; Miss. 13	96,256
Greenville loamy sand	Ala. 8; Fla. 6	62,144
Sassafras loamy sand	Md. 1, 4	57,024

[1] For key to numbers in this column, see p. 253.

Norfolk loamy sand.—The soil, to a depth of about 10 inches, is a gray or brownish medium textured sand containing enough silt and clay to give it a loamy consistency. The subsoil is a yellowish or brownish sandy loam of about the same texture as the soil. The topography is level to undulating with abrupt escarpments along the streams. It should be used for early vegetables and fruits.

Greenville loamy sand.—The type consists of a dark-red or reddish-brown medium to fine loamy sand or light-textured sandy loam, 12 inches deep, underlain by a lighter red slightly sticky sand resembling the soil in texture. The soil occurs mainly as gently undulating areas, low ridges, and knolls. While the type is well drained its water-holding capacity makes it a desirable and productive soil. It is admirably adapted to small fruits and vegetables and should, so far as possible, be utilized for this purpose. As a result of its capacity to retain moisture, unusual for a soil of so light a texture, cotton and corn give exceptionally good yields for a soil of this grade.

Sassafras loamy sand.—The soil is a dull-brown loamy sand, with a depth of 6 or 8 inches, and a gritty feel, due to the presence of considerable quantities of coarse sand and fine gravel. The subsoil consists of a pale yellow loamy sand, but at a depth of 15 inches the material is finer textured and frequently becomes very compact when dry. At about 30 inches the material changes to a moderately heavy sandy loam, and often below this to a loose coarse sand. The surface is in general gently rolling, but in some locations it is made up of low mounds and irregular ridges, with semi-swampy intervening depressions. The drainage is usually good, but crops are liable to suffer for moisture on the ridges. A poor soil for general farm crops, but well adapted to such truck crops as melons, cantaloupes, tomatoes, and sweet potatoes. The soil is easily cultivated and responds well to fertilizers.

THE FINE SAND GROUP.

The fine-textured sands of the Atlantic and Gulf Coastal Plains are the best general early truck soils, as distinguished from the earliest truck soils of coarser texture. On account of the fineness of the soil material they are more retentive of moisture, in conse-

quence of which, while not quite so early, they give heavier yields, with some improvement in the character of the products in that they have better quality, keep better, and can stand longer and slower shipment. Vegetables on the fine sands mature from ten days to two weeks later than on the sands. As a result of this difference in time of maturity south Georgia truck growers are producing their finer vegetables and larger yields on the fine sands, while the South Carolina districts, with a climate about two weeks later, are sending to market their very earliest truck from the sand soils. This is the compensating advantage to the more southern districts for their longer haul.

With an adaptation to the whole range of vegetable crops, the responsiveness of the soils to intensive culture, the good yields uniformly obtained in fair seasons, and the good quality of the crops, the soils of this group as a class are without doubt the most valuable early truck soils of the province. Differences in geographic position with respect to large bodies of water, which make the climatic conditions more uniform, topographic features (especially elevation), and transportation facilities have very much to do with selection of the kind of vegetables which can be grown, and even with the question whether the soil in any particular locality can at present be profitably used for trucking purposes. Under average conditions general farming can scarcely be conducted with success on soils of this texture.

TABLE V.—*Area and distribution of the fine sands.*

Name of soil.	State and area.[1]	Acres.
Norfolk fine sand	Ala. 2, 5, 8, 11, 24, 25; Fla. 1, 4, 5, 6; Ga. 7, 8, 11, 13; La. 3, 8, 10, 12; Md. 10; Miss. 1, 5, 13; N. J. 2; N. C. 5, 6, 7, 8, 15, 16, 17, 19; S. C. 4, 6; Tex. 1, 3, 6, 9, 11, 12, 13, 15, 18, 21, 24, 28; Va. 10.	1,595,072
Orangeburg fine sand	Ala. 5, 8, 11; Fla. 6; Ga. 7, 11; La. 2, 3, 8, 12; Miss. 6; Tex. 3, 11, 12, 15, 21, 22, 28.	475,008
Portsmouth fine sand	Fla. 3, 4; Ga. 7, 11, 13; N. C. 5, 15; S. C. 6	356,608
Lufkin fine sand	Tex. 3, 9, 12, 17, 21	230,400
Sassafras fine sand	Md. 1, 8; N. J. 2; Pa. 10	78,302
Leon fine sand	Fla. 4, 5	17,728
Caddo fine sand	La. 7	13,970
Nueces fine sand	Tex. 8	9,920
Mattamuskeet fine sand	N. C. 13	3,584
Webb fine sand	Tex. 14	3,136
Greenville fine sand	Ala. 8	2,432
Guin fine sand	Ala. 3	2,304
Durant fine sand	Tex. 10	1,600

[1] For key to numbers in this column, see p. 253.

Norfolk fine sand.—The soil is light-brown or gray fine sand about 8 inches deep, loose and incoherent when dry, but packing slightly

when wet. The subsoil is of much the same texture, though slightly heavier, lighter in color, and somewhat more coherent. The type occurs as low, rolling hills and level areas, and is generally well drained. It is adapted to about the same class of crops as the Norfolk sand, but is generally more productive. It is the best early truck, early peach, and small-fruit soil of the Coastal Plain. It produces only small crops of cotton and corn. In Florida the finest grade of wrapper tobacco is grown on this soil, but the yields average low, unless irrigation is practiced.

Orangeburg fine sand.—The soil is a gray to brown fine sand to fine sandy loam 15 to 24 inches deep. The subsoil is a red fine sandy clay to heavy fine sandy loam extending to a depth of 40 inches or more. In occasional areas the subsoil is a loamy fine sand to sticky fine sand. The type occurs as undulating to hilly and ridgy country, and owing to its location the surface drainage is good. It is easily worked under a wide range of moisture conditions and is largely under cultivation. It is well adapted to peaches, plums, melons, and early vegetables. It is the most productive soil of this group and better adapted to cotton and corn than the other soils. It is not quite so early in maturing vegetables as the Norfolk fine sand, but it is particularly valuable in Texas for the supply of early fruit and vegetables for the western markets. It is one of the best soils for cigar filler tobacco of the Cuban type of leaf.

Portsmouth fine sand.—The soil consists of 16 inches of fine sand of a dark-gray or black color. The dark color is the result of decayed and decaying organic matter. Where the usual drainage conditions prevail, the subsoil is a grayish to nearly white fine sand with or without a stratum of varying thickness consisting of reddish brown to chocolate-brown fine sand, cemented by iron. Below 3 feet a pure white sand, locally known as quicksand, is usually found. This type is of sedimentary origin and occupies level uplands. The natural surface drainage is but imperfectly established, and water stands at an average depth of about 2 feet below the surface at all times, while after heavy rains the surface is flooded for days at a time. The natural vegetation is longleaf pine, with an undergrowth of palmetto and gallberry bushes. Little of the type is in cultivation, but where drainage is established or secured through artificial means it is a fine soil for the late and heavy truck crops, such as celery, onions, potatoes, cabbage, and strawberries. On account of the large amount of organic matter, which makes it more retentive of moisture, it is not as early as the other soils of this group, but the yields are larger and the quality of the vegetables is very fine.

Lufkin fine said.—The type consists of gray fine loamy sand about 10 inches deep, resting on a subsoil of much the same character, but occasionally more loamy. At a depth of from 3 to 5 feet occurs a

gray or mottled stratified clay. The type is generally well drained, but occasionally small areas occur as depressions, and here the drainage is deficient. Such areas are locally referred to as "crawfish land." The natural forest growth is scrub pine and oak. The soil produces small yields of corn and cotton, but is adapted to early truck crops and peaches. The soil needs green manuring for the incorporation of more organic matter and to keep it in the best physical condition.

Sassafras fine sand.—The soil to a depth of 8 or 10 inches is a reddish-yellow to light-orange rather loose medium to fine sand. The subsoil is a reddish-yellow loamy fine sand. The type is inclined to be droughty, but it is easy to improve its moisture-holding capacity by addition of organic matter; in other words, it responds more readily to intensive methods than do some other soils of this group composed of more open and incoherent fine sands. It occupies low terraces, ridges, and hilltops. Under intensive culture it is an admirable soil for early peaches, small fruit, and early vegetables. It is well adapted to the Maryland type of tobacco in that State.

Leon fine sand.—The soil is a light-gray to white fine sand, underlain at about 12 inches by a white sand subsoil extending to a depth of 3 feet. The type has a nearly level surface, and, owing to its wet and in some places swampy condition, it is unfit for agriculture. Longleaf pine is the principal tree growth. In origin, topography, and drainage conditions the type is similar to the Leon sand, but it has a much finer texture. The soil is of little use in its present condition, and it is at least doubtful whether, excepting local areas, it would be worth while at the present stage of agricultural development of this country to improve it.

Caddo fine sand.—The soil to an average depth of 12 to 15 inches consists of a fine, loose, incoherent gray sand, often somewhat loamy. Beneath this and extending to a depth of 36 inches there occurs a lighter colored material similar in texture to the soil. A stiff, slightly mottled grayish clay is usually encountered below 3 feet. The type is of æolian origin, the sand having been drifted inland by the wind and laid down as a veneer over the older Tertiary clays. Its surface is for the most part comparatively level, though there are limited areas which are made up of dunes. The drainage is usually excellent. The type is devoted mainly to pasture, but under intensive methods it should be used in the production of early vegetables for the western markets reached by Texas growers.

Nueces fine sand.—The soil to an average depth of 12 to 15 inches consists of a fine, loose, incoherent gray sand, often somewhat loamy; and is underlain to a depth of 36 inches by a lighter colored material similar in texture to the soil. Below this depth a stiff, slightly mottled grayish clay is usually encountered. The type is of wind-blown

origin, the sand having been drifted inland by the wind and laid down as a veneer over the older Pleistocene clays. Its surface is for the most part comparatively level, though there are limited areas which are made up of dunes. The drainage is usually excellent. The type is devoted mostly to pasturage, but small areas are being planted to truck crops and cotton.

Mattamuskeet fine sand.—The soil consists of a brown or dark-gray fine sand, 36 inches or more in depth. The material is usually quite uniform throughout the soil profile, though a shallow covering of black, mucky material is found on the surface in places. When reclaimed by drainage the type should prove well suited to the production of vegetables.

Webb fine sand.—The soil, to a depth of about 12 inches, consists of a fine loamy sand of red to reddish-brown color. The upper 1 or 2 inches of the surface is usually a loose, incoherent fine sand, but the structure of the soil as a whole is very compact. The surface material grades into a subsoil which is quite similar to the soil both in color and texture, though it usually becomes more loamy in the lower part of the profile, and at a depth of 20 to 36 inches is a very light sandy loam of a red to reddish-brown color. The type occupies comparatively level or gently rolling upland areas. It is derived mainly from the weathering of underlying fine-grained sandstones. The soil supports a heavy growth of native grasses, which causes it to be classed as very good native pasture land. Besides the grasses, vegetation consists mainly of cactus and mesquite. Under irrigation it should be used for early truck crops.

Greenville fine sand.—The soil is a brown to reddish-brown loamy fine sand 18 to 20 inches deep. The subsoil is a red heavy fine sandy loam to fine sandy clay, having a deeper color below 20 to 30 inches. The type occupies gentle slopes and undulating areas. Cotton and corn give fair yields, the latter proving the most successful. Cowpeas, velvet beans, peanuts, rye, and oats give very fair results, but the best use for the soil when suitable transportation facilities are available is for truck crops.

Guin fine sand.—The soil is usually a loose incoherent grayish fine sand about 12 inches in depth. The subsoil is a loamy fine sand of dull brownish color and frequently of great depth. The type is derived from the Tuscaloosa formation of Cretaceous age and occupies high divides at the norther border of the Gulf Coastal Plains. It is associated with areas of Susquehanna gravelly loam. On account of the deep leachy subsoil it is of limited agricultural value.

Durant fine sand.—The type consists of 3 or 4 inches of light-gray fine sand, underlain to a depth of 30 to 36 inches by a reddish-gray or yellowish-gray fine sand. It has been formed largely by wind

action and is still being drifted. It is of very little importance, being naturally unproductive. It is easily cultivated and better adapted to truck than any other crop. The topography varies from gently rolling to rolling and the drainage is good.

THE SANDY LOAM GROUP.

The sandy loam soils constitute the *medium early truck* and *light general farming* soils of the Atlantic and Gulf Coastal Plains. They are the lightest desirable soils for general farming, are more retentive of moisture than the fine sands, and mature crops about two weeks later. The keeping quality of truck is better and the yields heavier than with either the fine sands or sands. General farming comes in on the sandy loams, but the yields are rather light, except under intensive methods of cultivation, including the frequent incorporation of vegetable matter and liberal application of manures.

Medium early melons, cucumbers, cabbage, tomatoes, garden peas, beets, lettuce, Irish and sweet potatoes, radishes, string beans, and blackberries give good results.

In the South Carolina trucking section the well-drained sandy loams mature crops about the same time as the fine sands of eastern North Carolina, the difference in climate being about two weeks.

Of the general farm crops peanuts, sorghum, early cotton, dent corn, cowpeas, velvet beans, and bright tobacco give moderate to good yields, according to treatment.

In the fight against the boll weevil, cotton growers using the sandy loams have a very decided advantage in the rapidity with which the crop attains maturity. Corn matures early and is of somewhat inferior quality and does not keep so well as that grown on the heavier soils. Wheat and hay do not come in as factors to be counted on in the farming system, although they may be produced incidentally in connection with the intensive treatment of the truck fields.

For general farming on this class of soil the lightest equipment of labor, teams, and buildings is required, and therefore the smallest investments, but this is offset by the smaller crop returns. The individual types differ materially on account of drainage and other conditions, which will be stated, indicating a difference in the use and value of individual types from this general statement, intended to apply to the group as a whole and to by far the largest proportion of the area covered by the included soils.

TABLE VI.—*Area and distribution of the sandy loams.*

Name of soil.	State and area.[1]	Acres.
Norfolk sandy loam	Ala. 1, 2, 3, 8, 15, 20, 21, 24, 28; Fla. 1, 2, 3, 6; Ga. 1, 7, 11, 12, 13; Miss. 6; N. J. 1, 2; N. C. 6, 8, 15, 17, 18, 19, 20; S. C. 6, 7, 9, 11, 12, 13; Tenn. 6; Tex. 21, 29; Va. 5, 6, 12.	2,000,850
Portsmouth sandy loam	Ala. 15; Del. 1; Fla. 3; Ga. 7, 11; Md. 4, 10; Miss. 13; N. C. 6, 8, 17, 18, 19, 20; S. C. 6, 7, 9, 11, 13; Tex. 22; Va. 10, 12.	774,052
Orangeburg sandy loam	Ala. 1, 5, 8, 14, 15, 18, 20, 21, 24, 28; Fla. 1; Ga. 7, 11, 12; La. 2, 3, 4; Miss. 6, 7, 11; S. C. 7, 9, 11, 12, 13; Tex. 20, 21, 29.	507,648
Lufkin sandy loam	Tex. 3, 16	362,944
Sassafras sandy loam	Del. 1; Md. 1, 4, 8, 9, 10; Va. 10	332,410
Tifton sandy loam	Ga. 4, 7, 11, 12	222,848
Collington sandy loam	Md. 1, 8; N. J. 1, 2	152,486
Greenville sandy loam	Ala. 1, 2, 8, 15; Fla. 6	104,896
Chesterfield sandy loam	Va. 5	95,680
Glenn sandy loam	Ala. 22	73,600
Susquehanna sandy loam	Md. 1; Tex. 21	21,888
Guin sandy loam	Ala. 3, 18	21,312
Montrose sandy loam	Miss. 6	20,928
Elkton sandy loam	Md. 4	9,280
Harley sandy loam	Okla. 2	8,832
Hoffman sandy loam	N. C. 20	8,576
Gadsden sandy loam	Fla. 4, 5	6,592
Scranton sandy loam	Miss. 13	640

[1] For key to numbers in this column, see p. 253.

Norfolk sandy loam.—The type consists of a coarse to medium yellow or gray sand or light sandy loam, 12 to 20 inches deep, resting on a yellow light sandy clay subsoil. It occupies level or gently rolling land. It is adapted to sweet and Irish potatoes and to other vegetables which reach maturity after those produced on the lighter textured soils. It is one of the best soils for peanuts, and in south Georgia and Florida ranks high for pecans and quite fair for the Sumatra type of cigar-wrapper tobacco. In the Carolinas it is a fine, bright (cigarette) tobacco soil, exceeded only by the Norfolk fine sandy loam. It is a typical cotton soil for an early crop. It is rather light in texture for corn, as under ordinary culture it produces small, early crops of rather inferior keeping quality, although used very extensively throughout the South for this crop.

Portsmouth sandy loam.—The type consists of a black, brown, or dark-gray sandy-loam soil, about 12 inches deep, frequently containing a very large quantity of organic matter, underlain by a gray or mottled sandy clay subsoil, which usually rests upon a compact sand, sometimes having the properties of a hardpan. The type occupies level or slightly depressed areas in the uplands, and the drainage is usually poor. When drained this type of soil is adapted to corn, potatoes, and later crops of truck, particularly strawberries. The large content of organic matter and the influence this has on the

water-holding power makes the soil comparatively late in maturing crops, but gives a larger yield than would otherwise be expected from soils of this grade.

Orangeburg sandy loam.—The type consists of a coarse to medium dark-brown sand or light sandy loam, from 4 to 15 inches in depth, resting on a red sandy clay subsoil usually containing small gravel and iron concretions. It occupies rolling to level upland ridges and slopes, and is adapted to general farming, giving good yields of cotton, which matures early, and moderate yields of corn. It is best suited for truck crops and peaches for a medium early market. In Florida, Alabama, and Texas it is desirable for a cigar wrapper and the Cuban type of filler tobacco.

Lufkin sandy loam.—The soil is a gray to brown medium loamy sand, or light sandy loam, varying in depth from 8 to 20 inches. The subsoil consists of a drab and yellow mottled, tenacious, impervious, sandy clay, often streaked with iron stains. Iron concretions and sometimes lime concretions in small quantities occur in both soil and subsoil, and thin beds of gravel are sometimes seen. The topography is flat to rolling. The greater part of the type has good drainage. Cotton and corn are the principal crops. Sorghum and Irish potatoes produce well and truck crops are grown with success. The timber growth consists largely of post oak, with some black-jack oak, and along the streams live oak.

Sassafras sandy loam.—The soil is a light-brown or brown, moderately heavy sandy loam, varying from 9 to 12 inches in depth. The subsoil is slightly heavier than the soil and varies in color from reddish yellow to reddish brown. In the lower depths it grades into coarser material. The surface features vary from broken stream slopes to moderately rolling and nearly level uplands. Formed from the weathering of marine deposits brought down from the region of crystalline rocks to the northward. It is adapted to corn, wheat, tomatoes, and grass, besides all kinds of truck, berry, and fruit crops suited to the climate. It is one of the most productive soils of this grade, being more productive than the Norfolk sandy loam.

Tifton sandy loam.—The type consists of gray or yellowish-gray medium sandy loam soil about 10 inches in depth, overlying a heavier, more compact, medium sandy loam to sandy clay of ocherous-yellow or cotton-seed meal color. Both soil and subsoil contain numerous iron gravel, giving a pebbly appearance, locally spoken of as "pimply land." The topography is gently undulating to somewhat hilly, the drainage is nearly always good, and the crop yields are considerably higher than those of the associated Norfolk soils. It is a valuable soil for medium early truck and peaches, and especially valuable for cantaloupes, cucumbers, potatoes, and strawberries. It is the best cotton soil of this group, and in favorable localities is

especially adapted to the Sea Island or long-staple cotton. It is an excellent soil for sugar cane, although the quality of sirup is not generally so good as in case of that made from cane grown on the deep phases of the Norfolk sandy loam or the Norfolk fine sandy loam. It is a good soil for corn, oats, peanuts, and forage crops of the locality.

Collington sandy loam.—The soil is a loose, loamy brown sand, from 9 to 20 inches deep, usually containing considerable coarse sand, and is underlain by a yellow or greenish-yellow, sticky, sandy loam or sandy clay subsoil. The type is derived from the weathering of green glauconite sand, and at 30 to 40 inches pure greensand occurs. The soil is very productive, and is used for general farming, small fruits, nursery stock, truck, and tobacco.

Greenville sandy loam.—The soil consists of a reddish-brown medium sandy loam, about 12 inches deep. The subsoil is a sticky sand to sandy loam, becoming heavier with depth, and having a brick-red color much like that characterizing the subsoil of the Orangeburg soils. The type occupies level to gently rolling country. On account of its open character it is well drained in the surface portion and the subsoil is capable of retaining a favorable quantity of moisture. It is an exceptionally good soil, being one of the most productive types of the sandy loam group. It is well adapted to cotton, corn, and truck crops.

Chesterfield sandy loam.—The soil type consists of a light-gray sandy loam from 4 to 6 inches deep, below which and extending to a depth of from 12 to 24 inches is a very light sandy loam, having a slightly yellowish color. In many cases this underlying material is almost a pure sand. The type usually occurs in broad and uniform areas and has a topography varying from moderately rolling to level. There is considerable variation in the crop yields. The soil is usually low in organic matter and the addition of such material is necessary to secure the most profitable returns. Corn, wheat, and oats, the principal products grown, give small yields. Small areas are sometimes devoted to the cultivation of tobacco, but where transportation facilities are suitable the best use will be for medium early truck and peaches.

Glenn sandy loam.—The soil has a depth of 12 inches and varies from a loamy sand to a light sandy loam of gray or grayish-brown color. The subsoil is a yellow, slightly mottled sandy loam, or loam becoming more sandy below 30 inches. Waterworn white gravel occasionally occurs. The type occupies slopes and in some cases may extend over ridges. The surface drainage is good. The soil is derived mainly from a thin layer of Coastal Plain material laid down over sandstone, which latter has contributed to some extent to the formation of the soil. Sandstone fragments occur on steep hillsides.

Areas of this soil are largely forested to white, post, and black-jack oak, and what little is cultivated yields poor crops of corn and cotton. It should be used for potatoes, peanuts, and truck crops, and for peaches.

Susquehanna sandy loam.—The soil is an open-textured gray sandy loam, carrying little organic matter, and varying from 12 to 20 inches in depth. The subsoil is a stiff red clay which is somewhat brittle, owing to the presence of some coarse and medium sand. In the lower depths the subsoil becomes mottled with yellow and gray. This soil is usually found upon gentle slopes reaching down to the streams, but also occurs at higher elevations in nearly flat and gently rolling stretches. The drainage is good. Post oak and black-jack oak is the characteristic vegetation. Small yields of cotton and corn are secured, but the type is best suited to medium early truck. In Texas peaches are grown successfully.

Guin sandy loam.—The soil, to a depth ranging from 15 to 36 inches, consists of a gray or white sandy loam or a fine sand; the subsoil is a reddish or yellowish sandy clay. Bands of gravel occur frequently and iron crusts are sometimes present. The type occupies steep slopes and narrow valleys and has excessive drainage. It is not well adapted to general farming or trucking, and should be allowed to remain in forest.

Montrose sandy loam.—The soil is a gray sand or sandy loam varying in depth from 4 to 16 inches. The sand content is frequently of the coarser grades and some gravel is usually present. There may be an accumulation of organic matter in the first few inches which makes the soil darker. The subsoil is a plastic gray and yellow or gray and red mottled sandy clay. The red coloring increases with depth. The topography is generally level and frequently the drainage is inadequate, especially along streams. Practically all of the type is forested with longleaf pine or oak. On the few areas cultivated cotton is the principal product. The yield of corn is low. The type is not adapted to fruit, though vegetables will do fairly well.

Elkton sandy loam.—The soil, which varies from 6 to 10 inches in depth is a dark-gray, clammy, rather silty, sandy loam becoming lighter in the lower portions. The subsoil varies from a medium heavy sandy loam to a loam and carries considerable silt. It is clammy and frequently mottled with red and yellow streaks and becomes intensely mottled in lower depths with gray, red, yellow, and brown colors. Alternating thin strata of clay and sand are common at about 30 inches and below, and the sand is always saturated with water. The type is found as flat, depressed, poorly drained areas at heads of small streams and possesses very poor natural drainage. It

is derived from marine deposits which have weathered under poor conditions of drainage. The usual trees are sweet and black gums, white oak, and maple. By extensive drainage and liming it could be made a productive type of soil, but it is questionable if this would be justified except locally.

Harley sandy loam.—The soil consists of a grayish-brown loamy sand to sandy loam, with an average depth of 10 inches. The subsoil to a depth of 3 feet or more is a waxy, tenacious clay varying in color from red to yellow and occasionally drab. Both soil and subsoil contain small quantities of gravel, consisting of quartz and feldspar derived from weathered granite. The type occupies low, rolling hills and slopes of small stream valleys. The greater part of the type is forested with oak. Small areas have been cultivated and planted to cotton and corn, both of which give good yields. The soil, however, is best adapted to potatoes, truck crops, and small fruits.

Hoffman sandy loam.—The type consists of 2 or 3 inches of grayish loose sand underlain to a depth of 6 or 8 inches by pale yellow or slightly pinkish incoherent sand to coarse sand. The subsoil is a slightly friable sand to coarse sandy clay of deep pink to red color, often with slight white, drab or yellowish mottling. Iron concretions and fragments of ferruginous sandstone are frequently encountered, especially on the surface of small knolls, where the sandy surface portion has been partly removed by erosion. The type occurs principally as slight ridges and knolls and as slopes along drainage ways which is closely associated with the sandhill phase of the Norfolk sand. It is well drained and is mainly forested with scrub oak and scattering longleaf pine. Some of the more nearly level areas are used for cotton and corn. Low average yields are secured.

Gadsden sandy loam.—The type consists of a brown sandy loam from 8 to 14 inches deep, underlain by a grayish-yellow or yellow sand or light sandy loam subsoil with a depth of 3 feet or more. The sand is usually of the medium grade, but occasionally the coarse sand content is considerable. The type occurs on slopes and in depressions, where it represents wash or creep from higher lying areas. It produces good crops of cotton and corn, and, in the low-lying areas, sugar cane does well.

Scranton sandy loam.—The type consists of a dark-gray medium to coarse loamy sand, 18 to 24 inches deep, overlying a sticky sand or sandy clay of bright-yellow to grayish-yellow color. It usually occurs near streams, where drainage is superior, and is generally slightly rolling. The principal tree growth is longleaf and shortleaf pine. It is adapted to the medium early truck crops.

COARSE SANDY LOAM PHASE.

The three following soils constitute a subclass or phase of the above group, less desirable on account of their more open structure.

TABLE VII.—*Area and distribution of the coarse sandy loams.*

Name of soil.	State and area.[1]	Acres.
Orangeburg coarse sandy loam	Fla. 6; S. C. 9, 13	25,024
Portsmouth coarse sandy loam	N. C. 20	8,000
Norfolk coarse sandy loam	Va. 12	4,288

[1] For key to numbers in this column, see p. 253.

Orangeburg coarse sandy loam.—The soil is a grayish brown to dark-brown coarse sand, or loamy coarse sand, with a very open structure to a depth of 10 inches. The subsoil is lighter colored than the soil and is a little more tenacious, owing to slightly greater clay content. The type is very uniform. It is nearly level, but possesses excellent underdrainage. It is an easy soil to work and is practically all in cultivation to corn, cotton, and oats. The yields are usually low, and heavy applications of fertilizer are necessary to profitable cultivation.

Portsmouth coarse sandy loam.—The soil to a depth of about 8 to 20 inches is a black coarse sandy loam high in organic matter. The subsoil is a tenacious coarse sandy clay, mottled reddish yellow and drab. The type owes its high organic-matter content and mottled colored subsoil to imperfect drainage, which has favored the accumulation of organic matter and inhibited soil aeration. For its profitable utilization drainage is necessary. When thoroughly drained it is an excellent corn, strawberry, cabbage, onion, lettuce, beet, and celery soil. Oats do fairly well.

Norfolk coarse sandy loam.—The soil, to a depth of 8 inches, consists of a brown to yellowish coarse sandy loam. The subsoil is a yellow sandy loam extending to a depth of about 24 inches, where it rests upon coarse sand and gravel. Both soil and subsoil contain about 25 per cent of waterworn gravel, chiefly quartz. The surface is level or gently sloping. The areas of this type represent outwash plains of sand and gravel mixed with finer materials. Small crops of corn, grain, and especially of small fruits are produced, but failures occur in years of drought.

THE FINE SANDY LOAM GROUP.

The fine sandy loams are adapted to medium truck crops—those coming in between the medium early and the medium late crops. These soils give moderately good yields of fairly firm and good textured vegetables having shipping qualities somewhat better than the earlier crops, but not so good as the later crops. Owing to their

retentiveness of moisture average yields of the general farm crops are secured and they are, therefore, classed as medium-grade general farming soils. In general, crops mature about two weeks later and the yields average higher than on the sandy loams.

Of the vegetables, melons, cucumber, cabbage, beets, tomatoes, garden peas, lettuce, Irish and sweet potatoes, radishes, string and lima beans, cauliflower, spinach, eggplant, squash, and carrots do particularly well. Certain varieties of strawberries, dewberries, and blackberries give excellent results.

Cotton matures somewhat later than on the sandy loams, but quite early enough to make these soils well suited to growing the crop under boll-weevil conditions. Medium good yields of dent corn, sugar cane, rye, and oats, and good yields of peanuts, bright tobacco, cigar-wrapping tobacco, cowpeas, velvet beans, crimson clover, and sorghum are made. The quality of sirup from sugar cane grown on the fine sandy loams is exceptionally good.

TABLE VIII.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Norfolk fine sandy loam	Ala. 1, 2, 5, 8, 11, 14, 15, 18, 21, 23, 24, 26; Fla. 1, 2, 4, 5, 6; Ga. 1, 5, 7, 11, 13; La. 2, 3, 4, 12; Miss. 1, 2, 6, 7, 8, 10, 13; N. C. 5, 6, 7, 8, 15, 16, 17, 18, 19; S. C. 4, 6, 7, 9, 11, 13; Tex. 1, 6, 9, 11, 12, 17, 18, 19, 21, 24, 27; Va. 5, 6, 10, 12.	4,346,672
Orangeburg fine sandy loam	Ala. 1, 2, 3, 5, 11, 14, 23, 24, 25, 26; Ark. 3; Fla. 2, 4, 5, 6; Ga. 1, 5, 7, 11; La. 2, 3, 4, 8, 10, 11, 12; Miss. 1, 2, 3, 4, 6, 8, 9, 10, 13; N. C. 7, 19; Okla. 2; S. C. 6; Tex. 1, 3, 11, 12, 13, 15, 17, 19, 20, 21, 28.	2,494,400
Susquehanna fine sandy loam	Ala. 3, 5, 8, 18; Ga. 7, 11; La. 2, 3, 4, 8, 12; Miss. 6, 8; Tex. 2, 3, 6, 7, 9, 10, 11, 12, 18, 21, 23, 24, 26.	1,611,648
Guin fine sandy loam	Ala. 14, 18, 22; Miss. 8, 12	541,632
Portsmouth fine sandy loam	Fla. 4; Ga. 7, 11, 13; Miss. 13; N. C. 5, 7, 8, 15, 16, 17, 18, 19; S. C. 4, 6, 9, 13; Va. 12.	433,828
Lufkin fine sandy loam	Miss. 2; Tex. 3, 7, 9, 15, 21, 24	267,328
Caddo fine sandy loam	La. 3, 7, 8, 12; Tex. 4, 6, 9, 11, 24	195,068
Lake Charles fine sandy loam	La. 1, 4, 7; Tex. 4	182,708
Webb fine sandy loam	Tex. 14, 28	110,528
Sassafras fine sandy loam	Md. 1, 2, 4, 8, 9; N. J. 1	101,676
Ruston fine sandy loam	La. 8	75,008
Durant fine sandy loam	Okla. 2; Tex. 10	72,576
Oktibbeha fine sandy loam	Ala. 14; Miss. 2, 8, 10	59,648
Scranton fine sandy loam	Miss. 13	50,752
Greenville fine sandy loam	Ala. 1, 3, 5; La. 8	24,960
Coxville fine sandy loam	S. C. 6	24,896
Elkton fine sandy loam	Va. 5	14,656
Mattamuskeet fine sandy loam	N. C. 13	11,584
Victoria fine sandy loam	Tex. 8	9,536
Bienville fine sandy loam	La. 2, 8	6,336
Crockett fine sandy loam	Tex. 21	4,416
Wilson fine sandy loam	Tex. 21	4,288
Grady fine sandy loam	Fla. 6	1,536
Boeuf fine sandy loam	La. 5	320

[1] For key to numbers in this column, see p. 253.

Norfolk fine sandy loam.—The type consists of a pale-yellow or gray fine sandy loam, 6 to 8 inches deep, underlain by a yellow fine sandy loam subsoil, grading into a light sandy clay at an average depth of about 18 inches. It occurs in level plains and rolling uplands and generally has good drainage. It gives a moderate yield of corn, and is very well adapted generally to truck crops and in parts of the South to cotton, and to bright yellow tobacco. The soil is not as valuable for early truck as the Norfolk fine sand, but is an excellent medium to late truck soil. In North Carolina it is esteemed a better tobacco soil than the Norfolk sandy loam and fully equal, if not somewhat superior, to the Norfolk fine sand. In Florida it is the safest and best soil for the Sumatra type of cigar wrapper leaf. It is well adapted to peanuts and forage crops of the locality, and, in the more southern areas, to pecans.

Orangeburg fine sandy loam.—The type consists of a gray or brown fine sandy loam, from 4 to 15 inches deep, underlain with a red sandy clay subsoil. The type occupies level and rolling to hilly areas in uplands and has good drainage. The soil is well adapted to truck crops, peaches, and in the Gulf States to Cuban filler tobacco. It is the principal peach soil of the Fort Valley area, Georgia. It is more productive than the Norfolk fine sandy loam and the productivity is more easily maintained. It is one of the best cotton soils of the province.

Susquehanna fine sandy loam.—The soil is a gray to brown fine sand or light fine sandy loam about 12 inches deep. The subsoil is a red or yellowish-red clay, usually stiff and plastic, and mottled, especially in the lower depths. Iron concretions are usually present in both soil and subsoil. The surface is characterized generally by a rolling or hilly topography, and erosion is sometimes quite pronounced. This soil is adapted to fruits and vegetables, potatoes and peaches doing exceptionally well in Texas. Cotton and corn give medium yields.

Guin fine sandy loam.—The soil is a light-brown or gray fine sandy loam 8 to 16 inches deep. The subsoil to 36 inches is a sandy clay usually brownish red, though in some cases it has an orange or yellow color. The texture of the subsoil is also variable. A small quantity of waterworn gravel is usually present in both soil and subsoil, and fragments of iron crust are occasionally encountered. The surface is mostly hilly to broken and drainage is likely to be excessive. Oak, hickory, and pine were the original timber. Cotton, corn, and oats are the principal products, while alfalfa and cowpeas may be successfully grown. Medium late vegetables do well.

Portsmouth fine sandy loam.—The soil is a black or rusty brown mucky, fine sandy loam, compact, wet, and heavy, with an average depth of about 12 inches. Large quantities of organic matter, in

all stages of decomposition, are usually present. Under continued cultivation the soil becomes lighter in both color and texture and the sand content more pronounced. The subsoil is usually a mottled drab and yellow sandy clay, massive and sticky, with a depth of more than 36 inches, and is underlain occasionally by a layer of very fine white or gray sand. Where the type occurs within sand areas, the subsoil often consists entirely of sand. It is characterized by level and slightly depressed surface features. Lack of drainage is responsible for the existence and peculiar characteristics of the type. In most cases artificial drainage is impracticable, owing to the difficulty and expense of securing adequate fall. The type supports a heavy growth of cypress, gum, magnolia, and other water-loving trees and undergrowth. When cleared and properly drained Irish potatoes and cabbage, especially the latter, are successfully grown. Cotton and corn give fair yields in favorable situations. The type is well adapted to onions and some of the berry fruits. It is especially well adapted to certain varieties of strawberries.

Lufkin fine sandy loam.—The type consists of a gray or brown fine loamy sand or light sandy loam about 12 inches in depth, resting on a plastic, impervious mottled gray and yellow sandy clay subsoil. The surface is level to rolling, and drainage is generally well established. The timber growth is chiefly scrub oak. Cotton and corn are the principal crops, but the type is naturally better adapted to medium late truck.

Caddo fine sandy loam.—This soil resembles the Norfolk fine sandy loam in a great many respects, the chief difference being in the topography and in the color of the subsoil. The soil consists very largely of fine sand, very fine sand, and silt, of a gray, brown, or yellowish color. Its depth varies from 8 to 30 inches and depends largely on the nature and number of the sand mounds by which it is characterized. The more silty materials collect at the base of the mounds and become so compact as to be almost impervious to water while the fine sand of the mounds is quite leachy. The color of the soil varies, the intermound areas usually being dark brown, while the sandy hillocks are of a lighter color. The subsoil is usually heavy, being composed of silt and clay, except where the sand mounds are quite prevalent. Here it is usually lighter, having somewhat more the nature of the soil. The color of the subsoil is generally gray, though much of it is yellow and mottled red and gray. It is usually quite impervious to water, and in some cases the structure is such as to form a real hardpan. These hardpan areas are formed where the surface is flat and are usually very wet. Iron concretions sometimes occur in the surface 8 or 10 inches of the soil. The type occupies rather depressed positions and has a level to gently rolling topog-

raphy. It not infrequently marks the flat, swampy areas in which streams take their rise, and it is also found on the low, flat areas skirting lakes. Sugar cane, rice, and certain varieties of truck, such as strawberries and cabbage do well. Where the sand mounds are not so numerous as to interfere with flooding, the best use of the soil is for rice, the greater part of it being better adapted to this crop than any other. Corn and cotton are the principal crops for which the type is at present used.

Lake Charles fine sandy loam.—The soil is a dark-brown or black, changing sometimes to light-gray, heavy very fine sandy loam, 14 inches in depth. The subsoil is a loam which grades at 10 inches into a clay loam carrying some silt, which in turn is underlain by a mottled clay, often carrying lime or iron concretions. The type is found on the higher elevations and is marked by sand hummocks. It owes its texture to local erosion and admixture of sand from hummock areas. It is adapted to farm crops requiring a light soil and medium drainage, and to medium late truck crops.

Webb fine sandy loam.—The soil is a light-brown to reddish-brown fine sandy loam, with an average depth of 10 or 12 inches. A few rounded gravel are sometimes found scattered over the surface or mixed with the soil, but the type as a whole is generally free from gravel or rock fragments and is very uniform in texture and color. The subsoil consists of a very sandy clay, varying from brown to reddish brown in color. The upper part of this subsoil contains a considerable quantity of fine sand and has the characteristics of a very heavy, sticky, sandy loam, but it becomes heavier as the depth increases, and at 18 to 20 inches is a compact sandy clay, sticky and tenacious when wet, but still containing a relatively large percentage of medium sand. The type occupies level to gently rolling areas. Small areas have been put under irrigation. The soil is productive and under irrigation produces good yields. The irrigated land is used mainly for growing onions and is well adapted to this crop. Sweet potatoes, cabbage, turnips, and beets also do well with irrigation. Cowpeas do well on both the unirrigated and irrigated areas. Corn and sorghum give fair yields on unirrigated areas during favorable seasons.

Sassafras fine sandy loam.—The type for 2 or 3 inches consists of light-brown fine sandy loam, but grades gradually into a pale yellow material which extends to a depth varying from 12 to 20 inches. The soil has the texture of a silty fine sandy loam and is underlain by a clammy light silty loam of a reddish-yellow color. Found largely on lower flat lands along water fronts where the drainage is poor. It also occurs upon higher moderately rolling areas with better drainage. A portion of the type is devoted to general

farming, including such crops as wheat, corn, grass. It is also used successfully in the production of tomatoes. Poorly drained areas could be made productive by drainage.

Ruston fine sandy loam.—The soil is a light-gray or yellowish-gray fine sandy loam of variable depth, averaging about 20 inches. The subsoil is a buff or reddish-yellow, somewhat mottled heavy fine sandy loam or sandy clay. The subsoil is more plastic than that of the Orangeburg fine sandy loam and usually less so than that of the Norfolk fine sandy loam. The type occupies broad, high divides and long gentle slopes reaching to stream bottoms. The topography varies from nearly level to gently rolling, and the drainage, while usually good, is sometimes inadequate. The soil is inclined to be droughty, and the crop yields diminish under the usual methods of management. With better treatment it will make a fairly productive soil for the crops suited to this group.

Durant fine sandy loam.—The soil is a heavy fine sandy loam, with a depth of from 14 to 18 inches. It has uniformly a characteristic chocolate-brown color. The subsoil is heavier than the soil and grades into a heavy clay loam. The usual color of the subsoil is a mottled yellow and brown. The type occupies areas of rolling prairie. Cotton, corn, and oats, the principal crops grown, give fair yields. It is better adapted to vegetables under intensive methods of cultivation and to early fruits.

Oktibbeha fine sandy loam.—The type consists of 5 to 10 inches of brownish-gray to light-brown fine sandy loam, grading directly into a rather heavy yellowish-brown sandy clay, which becomes mottled at depths varying from 2 to 3 feet. Many phases occur, as a result of erosion and different drainage conditions. The topography is rolling, and except for local seepage drainage is good. The original growth consists of oak, hickory, and maple. The areas of this soil are largely under cultivation to cotton and corn, but their agricultural value is lessened by severe erosion. Peaches, pears, and plums do well.

Scranton fine sandy loam.—To a depth of 8 or 10 inches the soil is a dark-gray fine sandy loam. The subsoil is in the upper portion similar in texture to the soil, but becomes gradually heavier with depth. There is usually little or no mottling in the subsoil. The type occurs in relatively broad areas, with flat to gently undulating topography, and often forms gentle slopes between areas of the Norfolk and Portsmouth series. The drainage is better than that of the Portsmouth fine sandy loam and less well established than in case of the Norfolk fine sandy loam. The type is adapted to about the same crops as the Norfolk fine sandy loam, but on account of the higher content of organic matter is a stronger soil, though maturing crops somewhat later.

Greenville fine sandy loam.—The soil is a medium to fine textured red sandy loam, ranging in depth from 4 to 15 inches. The subsoil is a bright red sandy clay to a depth of several feet. The type occupies level plateaulike stretches in close proximity to streams and possesses good drainage. The native trees consist of red oak, white oak, post oak, and hickory. Cotton and corn are the chief crops grown and the yields are good. The soil is also well adapted to fruits and early truck crops. Irish potatoes, radishes, and onions give large returns.

Coxville fine sandy loam.—The soil from 6 to 20 inches, or to an average depth of about 10 inches, consists of a gray to dark-gray moderately heavy fine sandy loam. The subsoil is a stiff, rather plastic clay, ranging in color from yellow in the upper portion to mottled yellow, drab, and brilliant red in the lower portion. Small iron concretions and quartz gravel are sometimes encountered in both soil and subsoil. Its topography is generally undulating to flat savanna. When thoroughly drained by open ditches the type is well suited to cotton, sweet potatoes, and the Klondike strawberry. It is not as good an early truck soil as the corresponding member of the Norfolk series, but it is a better cotton and strawberry soil.

Elkton fine sandy loam.—The soil, to a depth of 10 inches, is a heavy, dark-gray medium to fine sandy loam, frequently containing a rather high percentage of silt, and having a slightly sticky feel. Below this, to a depth of 15 to 20 inches, is a very light yellow fine sandy loam, sometimes almost white, and not quite so heavy as the surface soil. The subsoil is mottled gray or bluish sandy clay, varying occasionally both in texture and color, showing a yellowish or drab color, spotted or streaked with iron stains. It is a wet and poorly drained soil, and little of it is under cultivation. A system of drainage must be established before agriculture can be made successful. Under good conditions of drainage fair yields of general farm crops and the heavier and later truck crops are obtained.

Mattamuskeet fine sandy loam.—The soil consists of a brown or black fine sandy loam, varying from 10 to 20 inches in depth. The subsoil is a gray or brown fine sand. When wet the soil material is decidedly mucky, but upon drying out it has the appearance of fine sandy loam, high in organic matter. Practically all of this type is under water, and will require extensive and costly drainage for its reclamation. When reclaimed it will be well suited to crops like cabbage, celery, potatoes, onions, and corn.

Victoria fine sandy loam.—The type consists of 12 to 15 inches of light-brown to gray fine sandy loam, underlain at about 36 inches by a lighter colored sandy clay, often somewhat mottled with iron stains, containing locally in the lower depths thin deposits of lime.

The surface features vary from nearly level to quite rolling, and the drainage is excellent. The surface material is wind-blown, having been carried from an old beach line to the adjacent areas and spread out as a veneer over the older calcareous clays of Tertiary age. With heavy fertilization it is an excellent soil for such early truck crops as onions and cabbage. Melons, tomatoes, lettuce, sweet and Irish potatoes also do well. The general farm crops, cotton and corn, produce fair yields.

Bienville fine sandy loam.—The soil to about 8 inches consists of a gray or light-brown fine sandy loam. At depths ranging from 15 to 24 inches the material becomes a light-brown or reddish-brown, sticky, fine sandy loam, and this continues through the remainder of the profile. The type occurs adjacent to large swamps and represents sandy depositions which took place along the edge of these or at the junction of large streams when large columns of water were flowing from the north. The areas are locally known as "hammock" land. They are above high water, and the gently rolling surface insures good drainage. It is an easy type to cultivate, and is well adapted to general farming and trucking.

Crockett fine sandy loam.—The soil is a dark-brown to nearly black fine sandy loam or heavy fine sandy loam with a depth varying from 6 to 12 inches. The subsoil is a loam passing into a stiff clay loam, which generally has red or yellow mottlings. Concretions of iron gravel are frequently present. The type occupies gently rolling prairie land marked with occasional gravelly hillocks. It has good drainage and is particularly suited for the production of oats and corn, and, under intensive culture, is adapted to truck and early fruit crops.

Wilson fine sandy loam.—The soil is a dark-gray to nearly black fine sandy loam varying in depth from 7 to 15 inches. The subsoil is a dark-colored clay loam which becomes very stiff and compact in the lower depths. Areas of this soil occur as high prairie land and adjacent to the Brazos River as flats similar in some respects to second bottoms. The drainage is thorough and the land is subject to drought in June and July. If allowed to stand uncultivated after rains it crusts and and is hard to manage. The native vegetation is largely mesquite. Practically all this soil is in cultivation in cotton and corn and fair yields of both are obtained, although corn is likely to suffer from drought.

Grady fine sandy loam.—The soil, to a depth of from 8 to 15 inches, consists of a dark-colored fine sandy loam. Below this occurs a tenacious, impervious, mottled drab, yellow, and red clay, containing varying quantities of the finer grades of sand. The type occupies nearly level to flat poorly drained country slightly elevated above the stream channel or swampy flood plain which it borders. Small flat

areas in the uplands occur as saucerlike depressions requiring artificial drainage. The soil contains a relatively large proportion of organic matter. The subsoil is frequently influenced by the close proximity of the underlying limestone which may be encountered within 3 feet. Sinks, depressions, and underground stream channels, formed by the solution of limestone, are characteristic features of some areas. The type in some localities is know as "hammock" land and is recognized as a productive soil. It produces good yields of sugar cane and corn in favorable seasons and with good drainage. The timber growth consists of oaks, beech, gum, magnolia, and scattering pine.

Boeuf fine sandy loam.—The surface soil is a brown, loamy fine sandy loam 8 inches in depth, and the subsoil a plastic heavy sandy clay. The line of division between soil and subsoil is sharply marked. At 30 inches the subsoil becomes lighter in texture, being sometimes a sandy loam. The type is found on small ridges, 15 to 30 feet above the surrounding flat, alluvial lands, and probably represents remnants of the Lafayette formation where the overlying loess has been largely removed. It is a very productive soil type and much of it is cultivated, producing 30 to 40 bushels of corn and nearly a bale of cotton to the acre.

VERY FINE SANDY LOAM PHASE.

These four soils are phases within the above group rather than a distinct group in themselves.

TABLE IX.—*Area and distribution of the very fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Norfolk very fine sandy loam	Fla. 4; N. C. 17, 19	41,536
Mattamuskeet very fine sandy loam	N. C. 13	35,072
Coxville very fine sandy loam	S. C. 6	12,288
Hyde very fine sandy loam	N. C. 13	11,968

[1] For key to numbers in this column, see p. 253.

Norfolk very fine sandy loam.—The soil is a gray to dark-gray very fine sandy loam of silty feel. Below the first few inches a yellowish very fine sandy loam is encountered which extends to a depth ranging from 6 to 12 inches. The subsoil is a yellow or light-brown silty loam to silty fine sandy clay sometimes mottled with reddish and grayish colors. The type is a mellow friable soil, easily tilled. It is liable to bake and harden after heavy rains, unless cultivated as soon as the soil has dried out sufficiently. The surface configuration varies from level to undulating or gently rolling, and is well suited to the

use of machinery in tillage operations. The level and depressed areas need ditching. The type is highly adapted to cotton. Corn, oats, sweet potatoes, and peanuts do well. Bright tobacco gives yields of average quality and quantity.

Mattamuskeet very fine sandy loam.—The type consists of a silty very fine sandy loam 36 inches deep. When wet the soil throughout the profile is brown in color, but upon drying it becomes dark gray or drab. In places a bluish silty clay or fine sandy clay is encountered at from 12 to 30 inches. When reclaimed by drainage this soil produces fine crops of corn, oats, peas, soy beans, and cabbage, particularly, and other truck crops for the late spring markets.

Coxville very fine sandy loam.—The soil is a dark-brown, mellow, very fine sandy loam of high organic matter content and from 10 to 24 inches deep. The subsoil is a drab to yellowish fine sandy clay, which quickly grades into compact rather plastic clay, mottled yellow, drab, and brilliant red. It occurs as flat and slightly depressed areas, usually as savanna or sparsely timbered land. When drained it produces good crops of cotton, corn, oats, forage crops, and strawberries. Applications of lime are beneficial.

Hyde very fine sandy loam.—The soil is a gray to dark-gray very fine sandy loam from 6 to 18 inches deep. The subsoil is a light-gray compact very fine sand or fine sandy loam. Areas of this type occupy slight ridges and low, flat, poorly drained situations. With the establishment of good drainage conditions the type is well suited to cotton, corn, oats, potatoes, and vegetables.

THE LOAM GROUP.

The loams constitute the best medium-late truck crops and all-round general farm crop soils of the Atlantic and Gulf Coastal Plains. They are easily kept in good condition of tilth and are very retentive of moisture. Vegetables mature rather late, but the yields are sufficiently heavy and the quality good enough to compensate, within certain limits, for the climatic and transportation advantages of more northern sections. By the time vegetables produced on the loams in the southern portion of the region are ready for shipment abundance of early truck is coming to maturity in the northern districts. This limits competition on the loams to those districts having sufficiently short and cheap transportation facilities to compete with the trucking districts to the north, but they are also valuable soils for supplying the local markets. The burden of competition would fall too heavily upon Georgia and South Carolina truckers using the loams, except in the production of noncompetitive crops like Bermuda onions, and the growing of products for immediate local consumption and for canning. Such crops as cauliflower, spinach, kale, egg plant, squash, asparagus, carrots, parsnips, Irish potatoes, tomatoes,

onions, cabbage, celery, beets, and cucumbers give the best results. Strawberries and raspberries also do very well. The earlier truck crops, even including tomatoes, when grown on soils of this texture may not find a ready market at good prices, and provision should always be made to can or otherwise preserve them for winter use.

Good yields of cotton, corn, and forage crops, such as cowpeas, velvet beans, crimson clover, vetch, and sorghum are secured. Heavy yields of sugar cane are made, but the sirup has not so good quality as that from the lighter textured soils. The Cuban type of cigar-filler tobacco does well on certain of the loams, but in case of the wrapper type the texture of the leaf averages rather too coarse for the trade.

It is upon the loam soils that small grains and grass begin to be advantageous. Good yields of wheat, oats, and rye are secured and grass for pasture does fairly well. In general farming the requirement for heavier farm equipment—teams, implements, and buildings—becomes very apparent, being absolutely necessary to develop the soils to the point of highest efficiency. Owing to a failure to appreciate and provide this more expensive equipment the possibility of the soils of this grade have not been fully appreciated in many sections. The group comprises the great general-purpose soils of the Coastal Plains province.

TABLE X.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Houston loam	Miss. 2; Okla. 2; Tex. 3, 7, 10, 20, 23, 26	252,864
Leonardtown loam	Md. 2, 8, 9; Va. 6, 12	196,514
Sassafras loam	Md. 1, 2, 4, 10; N. Y. 6	182,180
Norfolk loam	Ala. 2, 23; Fla. 1; Miss. 1, 12, 13; N. C. 5	174,912
Portsmouth loam	Ala. 2; Md. 4; Miss. 7, 13; N. C. 5, 6, 7, 8, 15, 16, 19; S. C. 12	132,480
Wilson loam	Tex. 3, 9, 10, 24, 28	126,272
Caddo loam	La. 7	51,280
Durant loam	Tex. 10	45,440
Glenn loam	Ala. 9, 22	42,688
Victoria loam	Tex. 8	40,896
Crockett loam	Tex. 3, 22	24,768
Greenville loam	Ala. 2, 14; Fla. 1; La. 2, 8, 12; Miss. 6	20,224
Webb loam	Tex. 28	17,088
Gadsden loam	Miss. 7	14,592
Lake Charles loam	La. 1, 7	6,378
Lamar loam	Tex. 7	5,696
Lufkin loam	Tex. 15	5,376
Susquehanna loam	Tex. 21	3,392
Elkton loam	Md. 4	2,624
Grady loam	Ga. 7	896

[1] For key to numbers in this column, see p. 253.

Houston loam.—The soil is a gray to light-brown loam, with an average depth of 10 inches, containing a considerable amount of silt.

It is friable and when cultivated has a desirable tilth. The subsoil is a drab to slate-colored silty clay, containing noticeable amounts of fine sand. It becomes heavier with depth, and at 36 inches is a stiff, plastic, silty clay, often slightly mottled and containing a small percentage of fine sand. Small rounded pebbles are sometimes encountered in both soil and subsoil. The type occupies slightly rolling upland prairies, and except in some depressed areas the drainage is good. The Houston loam occurs between the heavy black clay lands of the prairie and the sandy timber lands, and has been formed by the intermingling of the materials from these regions. It is best adapted to early maturing crops, as droughts of the late summer months seriously affect the yield and often the full maturity of the crop. Good crops of cotton, corn, oats, and sorghum are produced. It is adapted to alfalfa and this is the best forage crop for this soil.

Leonardtown loam.—The type consists of a yellow silty loam 9 inches deep, underlain by a red and mottled clay loam subsoil, frequently containing clay lenses and pockets of sand. The type occupies slightly rolling uplands and is a good soil for general farming, particularly for corn, wheat, and grass. It has good dairying possibilities for the type of dairying where the pasture enters as the basis of the feeding system. Much of the area of this type is waste land or grown up in white oak and pine forests, and some of the more level areas need underdrainage. The soil is deficient in organic matter and is greatly benefited by lime. Except on a few farms properly equipped the great possibilities of this soil have never been realized. Under efficient methods it is an excellent soil for the heavy truck crops, like cabbage, and for canning crops.

Sassafras loam.—The soil is a brown to yellowish-brown moderately heavy loam varying in depth from 8 to 16 inches. A little fine quartz gravel is sometimes present. The subsoil to 24 inches is a reddish-yellow or a reddish-brown heavy loam, a trifle heavier than the soil, it passing at lower depths into a reddish-brown coarse sandy loam. Its surface varies from broken stream slopes to nearly level uplands. The drainage is good. The type is ideally adapted to wheat, corn, grass, and all kinds of forage crops, and is also well suited to tomatoes, beans, and cabbage and canning crops in general. This is the best general-purpose soil of the Coastal Plain province.

Norfolk loam.—The soil is a brown loam or fine sandy loam, usually containing a very small amount of fine gravel. The subsoil is a yellow loam containing considerable sand, which is frequently underlain by a yellow sand of medium grade or by gravel. The type occupies level to undulating areas. It is easily tilled, well drained, and produces fair yields of general farm crops. It is especially well adapted to sugar corn, peas, and tomatoes, usually for canning purposes, and also to peaches, summer apples, and pears. It is too heavy

a soil for early truck and not sufficiently heavy to be considered a first-class general farming soil. It is one of the best corn soils of the province, but it is too light for wheat, oats, or hay.

Portsmouth loam.—The type consists of a dark-gray to black fine-textured loam, about 12 inches deep, underlain by a gray or somewhat mottled heavy loam subsoil grading sometimes into a mottled gray or yellow silty clay. It occupies flat, upland areas, with naturally very poor drainage, but when drained and properly cultivated is well suited, according to locality, to corn, cotton, sugar cane, and forage plants, and to late spring potatoes, cabbage, and onions. With proper drainage it is one of the best, if not the best, corn soil of the province.

Wilson loam.—The soil consists of 9 to 10 inches of dark-gray or dark brownish gray loam. The subsoil is a mottled red, yellow, gray, or drab silty clay or heavy loam, becoming heavier with depth. The topography is level to gently rolling, and natural drainage is good. Only in exceptional cases is there a tendency to wash. On very level tracts drainage may be necessary. The type represents a gradation between the Houston black clay and the Lufkin fine sandy loam. A great deal of the type is in pasture, though under cultivation good crops of cotton and corn are secured.

Caddo loam.—The type consists of a dark-brown, brownish-gray, or gray silty loam, 6 to 16 inches in depth, grading into a clay loam subsoil 8 inches deep, beneath which are mottled clays. The type owes its origin to recent coastal deposits and is found in poorly drained areas or depressions containing scattered sand mounds. It is an excellent rice soil.

Durant loam.—The surface soil of the Durant loam consists of 10 to 15 inches of dark-gray or grayish-brown loam, containing a relatively high percentage of fine and very fine sand and silt. The subsoil is a stiff dark-brown or yellowish-brown silty clay. The subsoil, in lower lying areas, is sometimes mottled, and also shows a few reddish-brown iron stains, the result of decomposed iron concretions. In topography the type varies from almost level, its usual condition, to slightly rolling. During an average year the drainage is good, except in an occasional small depression. The type is derived principally from the Woodbine formation. It is adapted to corn and cotton. Peanuts and fruit also do well.

Glenn loam.—The soil varies from a heavy fine sandy loam to a loam or silty loam and has a depth of 10 inches. The color varies from light yellow to a brownish yellow. The subsoil is a compact yellow loam, sometimes mottled with gray below 24 inches. The type occupies level to gently rolling elevated areas, which insures good drainage. Carboniferous sandstone is frequently encountered at from 4 to 6 feet and may have contributed to the soil formation.

Areas of this soil support an open forest of oak and hickory, in which native grasses grow well. Corn, cotton, and oats are the principal cultivated crops. Apples do well, but peaches do not.

Victoria loam.—The type consists of 10 or 12 inches of light-brown loam, passing gradually into a grayish clay, which becomes heavier and more compact as the depth increases. Small deposits of lime are found in the subsoil. The type occurs throughout the uplands as level or gently undulating areas, with generally good surface drainage. It is formed largely from light, wind-blown material mixed with the heavier underlying clays of Tertiary age. It is a very productive soil and is well adapted to truck crops as well as to cotton, corn, and other general farm crops.

Crockett loam.—The soil to a depth of 8 to 12 inches is a dark-gray loam to clay loam, quite heavy and containing some fine sand, considerable organic matter, and occasionally a small percentage of waterworn gravel. The subsoil to a depth of 36 inches is a mottled yellow, gray, and red sandy clay. The sand content ranges from medium to fine and the red color may be in streaks. The type occupies comparatively level slopes adjoining stream courses and has good drainage. It is probably derived from the intermingling of some of the Houston black clay material with surrounding types and represents the occurrence of the old San Antonio prairie. It is largely under cultivation and is devoted to cotton and corn.

Greenville loam.—The soil is a brownish to reddish loam or silt loam with a depth varying from 3 to 5 inches. The subsoil to about 36 inches is a friable, heavy, red clay loam. Below this depth it usually becomes mottled red and yellow in color. Considerable quantities of fine iron concretions are present in the subsoil, and these facilitate aeration and drainage. Areas of this soil occur as nearly level or slightly rolling land on divides. The drainage is only fair and underdrainage would be helpful. It is an excellent soil for cotton and oats and a good soil for corn and grass. It is usually not well adapted to truck crops. The type, as a whole, is susceptible of improvement, and once brought to a high state of productiveness, it is easily maintained there. It is highly adapted to the Cuban type of cigar-filler tobacco.

Webb loam.—The soil consists of about 18 inches of rather heavy reddish-brown loam. The subsoil is reddish-brown or brown clay loam, grading at about 24 inches into a stiff, compact, red or yellowish-red clay. In both soil and subsoil are found a few iron concretions and occasionally a few rounded pebbles. The type has a gently undulating surface, and is well drained. The natural growth is mesquite and in only a few places have the areas been cleared. Cotton, corn, and sorghum are the principal crops, the yields being fair.

Gadsden loam.—The type consists of a dark yellowish-gray loam, rather light in character, from 8 to 18 inches deep, underlain by a yellowish-gray loam or clay loam subsoil of a somewhat heavier texture. The type occurs as moderately high bottom lands and bluffs. It is generally known as "hammock" land and supports a growth of hardwood timber. The soil is well drained and quite productive, and is adapted to cotton, corn, fruit, and late truck crops.

Lake Charles loam.—The soil is a dark-brown, black, or bluish loam, carrying a high percentage of organic material. At 14 inches a subsoil of clay loam appears, which at lower depths is underlain by mottled clay. The type owes its origin to local swamps into which fine loam has drifted. It is a heavy soil and difficult to till, but when properly cultivated it makes excellent rice land.

Lamar loam.—The type consists of a brown or yellow loam, with an average depth of 12 inches, underlain by a calcareous clay of lighter color. The subsoil contains fragments of limestone and lime concretions. The topography is rolling to rough and very badly eroded. It is derived from a very calcareous marl, and owes its characteristics to this material and to the rapid erosion which has removed the surface before thorough decomposition into the Houston black clay could take place. The land is used for pasture and has a straggling timber growth of oak and other hardwoods.

Lufkin loam.—The soil to a depth of from 3 to 10 inches consists of a loam, containing considerable organic matter and having a dark-gray color. The subsoil is a stiff, compact, dark-colored sandy clay. The surface of this type is flat with a few areas gently rolling, and in general is poorly drained. When well drained it is an excellent soil for corn and cotton, as well as for the late spring truck crops and strawberries.

Susquehanna loam.—The soil is a dark-brown loam or clay loam with a depth of about 6 inches. The subsoil is a stiff, plastic mottled clay. The type is found on high elevations, and is well drained. It is an excellent cotton soil and produces good yields of oats. Somewhat droughty for corn. Such truck crops as onions and cabbage do well. It is adapted to summer apples.

Elkton loam.—The soil varies from 6 to 10 inches in depth and consists of a dark-gray silty medium loam, which becomes lighter in lower portions. The subsoil is a heavy, clammy, silt loam to about 30 inches in depth. It changes gradually from gray or drab to an intense mottling of gray, red, or yellow and brown colors in lower depths. Alternating thin strata of sand and clay are common at 30 inches and below, and the sand is always saturated with water. The Elkton loam occurs as poorly drained depressions and flat land around heads of small streams. It is derived from marine deposits which have weathered under poor conditions of drainage. Sweet and

black gum, white oak, and maple are common. Under present conditions of drainage the soil is not suitable for farming. It may be improved by drainage and then, by thorough cultivation, be made to produce good crops of wheat and hay.

Grady loam.—The type consists of dull-brown light loam, underlain at from 15 to 20 inches by an extreme stiff and rather plastic drab clay, mottled slightly with reddish and yellowish colors. It occurs in a peculiar flat body which resembles stream bottom in topography and which lies at from 20 to 30 feet below the general upland level. The water of several streams running into this land spreads out and sinks into the ground, there being no drainage outlet. Sink holes into the underlying limestone are common. It is locally styled "slough land," on account of the peculiar drainage features. Mayhaw and water oak constitute the main part of the sparse or clumpy timber growth. The underlying limestone possibly has influenced slightly the subsoil of the type. None of this land is under cultivation. It is a local soil, and in a condition which would hardly justify improvement at the present time.

THE SILT LOAM GROUP.

The silt loams are adapted to late truck and vegetables for canning purposes, except only for a small supply of fresh vegetables for local southern markets, and to heavy farm crops. Vegetables mature so late on the silt loams that only special kinds or those grown for special purposes give profitable returns in the fresh vegetable market. These soils work up well, but are more inclined to compact after rains than the loams, on which account more intensive cultivation and heavier farm equipment are required to keep the soil in a highly productive state.

The well-drained silt loams give heavy yields of cabbage and Irish potatoes of good keeping qualities. Vegetables like tomatoes, asparagus, and cauliflower are profitably grown for canning.

The range of farm crops adapted to this group of soils is somewhat narrow, but the yields of such as should be produced are heavy. Corn, wheat, oats, clover, vetch, rice, and grass do particularly well. Good crops of cotton are secured under normal conditions of rainfall. In districts infested with the boll weevil early maturing varieties must be grown in order to mature the crop as far as possible before the weevil becomes most active.

Hay becomes an important crop on this group of soils. The soils as a group also make very good pasture. With the fine grazing afforded, dairying and stock raising are possible and profitable industries. As a rule the silt loams are the most difficult to control and maintain in a high state of productivity of any of the groups of soils in the province. This is because of their peculiar structure and their

liability to compact, except under the most intelligent control. They require a heavier farm equipment than the loams.

TABLE XI.—*Area and distribution of the silt loams.*

Name of soil.	State and area.[1]	Acres.
Sassafras silt loam	Del. 1; Md. 1, 2, 3, 4, 5, 6, 8, 9; N. J. 1, 2; Pa. 4, 10	518,142
Crowley silt loam	Ark. 4, 5; La. 1	477,120
Monroe silt loam	La. 10, 11; Miss. 11	300,992
Acadia silt loam	Ark. 4; La. 1	225,792
Portsmouth silt loam	N. C. 5, 16; Va. 10	181,760
Elkton silt loam	Del. 1; Md. 1, 3, 4, 5, 6, 8, 10; N. J. 1; Pa. 4	168,468
Lufkin silt loam	Miss. 2, 8, 10, 11; Tex. 9	72,832
Hammond silt loam	La. 11	70,976
Landry silt loam	La. 1	37,696
Norfolk silt loam	Ala. 18; N. C. 16; S. C. 6; Va. 5	37,056
Oktibbeha silt loam	Miss. 8, 10	36,224
Pheba silt loam	Miss. 2	22,336
Scranton silt loam	Miss. 13	18,112
Coxville silt loam	N. C. 17; S. C. 6	17,408
Susquehanna silt loam	Miss. 10	9,984
Hyde silt loam	N. C. 13	8,000
Mattamuskeet silt loam	N. C. 13	704

[1] For key to numbers in this column, see p. 253.

Sassafras silt loam.—The soil to an average depth of 8 or 10 inches is a light-yellow friable silt loam containing considerable fine sand, but little or no medium sand. The subsoil consists of a compact reddish-yellow or brownish silt loam, which increases slightly in clay content with depth. At depths 15 to 30 inches the material becomes somewhat granular. Flat to undulating interstream divides, with but fair natural drainage occur and ditches are sometimes required to remove surface water. Grass, forage crops, wheat, clover, and timothy all do well. Excellent for corn in favorable seasons. Should be used for crops which require long growing seasons, and for which continuous moisture supply is of first importance.

Crowley silt loam.—The soil is a silt loam, having an average depth of 10 inches. When wet the color is brown, but upon drying the color becomes an ash gray. This surface material is usually underlain by a gray or mottled gray and yellow silt loam to a depth of from 16 to 30 inches, below which a mottled gray, yellow, and red, heavy impervious silty clay is found. Both soil and subsoil contain lime and iron concretions. The type occurs as level or slightly rolling prairies and is one of the finest rice soils of southern Louisiana. During wet seasons water often stands upon the surface, but when drained the type is well adapted to cotton and oats.

Monroe silt loam.—The type consists of a fine sandy or silty loam 10 inches in depth, underlain by a yellow or red silty clay subsoil,

usually mottled with white or brown below 2 feet. Areas of this soil occur as low terraces or hills of slight elevation. The forest growth is oak and pine. Very little of the type has been cultivated, and that with very poor success. Cotton can hardly be made to yield one-half bale per acre and corn is even less satisfactory. It is not clear what is the cause of the low productiveness of this soil.

Acadia silt loam.—The type consists of a white or light ashy gray loose silt loam, from 16 to 30 inches deep, underlain by a silty clay subsoil of a mottled brown and yellow color. It occurs in rolling areas and very little of it is cultivated. The cause of the low productivity of this soil is not known.

Portsmouth silt loam.—The soil consists of a gray to dark-brown friable silt loam about 9 inches deep. It is frequently compact and inclined to puddle, and if plowed when too wet it forms clods, though these break down quite readily in subsequent cultivation. The subsoil is a gray or mottled gray and yellow heavy silt loam which, in the lower depths, sometimes becomes heavier and more greasy and waxy in character. The type occurs as flat, slightly depressed or low-lying areas which generally require drainage for successful cultivation. When well drained it is adapted to corn, hay, and oats, and in the South to such vegetables as cabbage, kale, and collards. It is particularly adapted to certain varieties of strawberries. It may be considered one of the best corn soils of the province and in appearance resembles the important corn soils of the Central States. It gives moderate yields of cotton.

Elkton silt loam.—The soil, to a depth of about 10 inches, is a grayish silt loam, and in well-cultivated fields is loose and floury, though it has a tendency to run together when wet and to bake upon drying. The subsoil is of a grayish color, somewhat darker than the soil, and is generally mottled with yellow and brown iron stains. The clay content of the subsoil increases slightly with depth. At about 3 or 4 feet there are alternating beds of clay and sand, the latter being invariably saturated with water. Level locations with sluggish surface drainage are found on low necks between estuaries and also occasionally in uplands. Most of this type of soil so far mapped is under cultivation. It is an excellent soil for timothy and good for wheat, but not especially good for corn. It is a difficult soil to manage in wet seasons and is greatly improved by drainage and manuring.

Lufkin silt loam.—To a depth of 10 inches the soil is a silt loam of a dark-gray color, containing a large amount of organic matter. Both the texture and color of the subsoil show wide variations, though it is usually a mottled gray, heavy silt loam, frequently containing iron concretions and some fine sand, and increasing in tenacity to a depth of 3 or 4 feet, where a stiff clay is found. The soil

becomes more sandy and the subsoil brighter in color as the elevation increases. The subsoil of the more elevated areas is usually a dark or dull yellow silt loam or clay. The type is level to moderately rolling in topography. Cotton is the principal crop grown. Oats do well under favorable conditions. The soil is not a good type for corn and it is poor for peaches and pears, though excellent for grapes and plums.

Hammond silt loam.—The soil is a silty or very fine sandy loam, with an average depth of 15 inches. The surface has an ashy-gray color, which changes to a dark gray or brown when wet. The gray color may continue the entire depth of the soil, but frequently changes to yellowish at 4 or 5 inches from the surface. The subsoil is a heavy silty clay of a yellowish color, with drab, brown, or red mottling. A few iron concretions are found. The type usually occupies level areas and the drainage is generally poor. It is deficient in organic matter and is not naturally a productive soil. It is fairly well suited to oats, crab-grass hay, sugar cane, and small truck. With heavy fertilization, large yields of strawberries are secured. The principal forest growth is longleaf pine.

Landry silt loam.—The type consists of a dark-brown silt loam, 10 inches deep, underlain by a heavy brown clay subsoil grading into greenish-yellow or drab clay. The subsoil contains numerous lime and iron concretions and differs from that of the Crowley silt loam in being more friable, less plastic, and having a more noticeable silty texture. The soil would be productive for rice, but the surface is so rolling that irrigation is impracticable and rice culture is therefore out of the question. It is a poor soil for cotton or corn.

Norfolk silt loam.—The type consists of a brown loam 10 inches deep, underlain by a heavy yellow loam subsoil, both containing a rather high percentage of silt. It occurs as level or gently rolling uplands or terraces. It is one of the most valuable soils of the province for general farm crops and is best adapted to wheat, corn, and grass. In New Jersey this soil produces as high as 25 or 35 bushels of wheat, 1 to 2 tons of hay, and from 50 to 70 bushels of corn per acre. It is esteemed an excellent soil for dairy farming. On the Eastern Shore of Maryland the yields are almost as high as in New Jersey. In southern Maryland, with lighter equipment, the yields are much less, but could be increased. The soil gives large yields of canning vegetables. It is the best general-purpose soil of the group.

Oktibbeha silt loam.—The type consists of 7 to 10 inches of rather sandy yellowish-gray silt loam, underlain by a yellow mottled friable silty clay, which extends to a depth of 3 feet or more. A heavy clay occurs at depths ranging from 6 to 8 feet. The soil is deficient in humus, is apt to be cloddy under cultivation, and is greatly benefited by lime. It occupies level to gently rolling flatwoods land in

which drainage is likely to be deficient. The timber is largely pine, post oak, red oak, and sweet gum. This type is one of the poorer soils of the province, and but little is under cultivation. Light yields of cotton and corn are produced. Artificial drainage and the incorporation of organic matter, the application of lime, and thorough cultivation would reclaim most of it, but this would be of doubtful economy in the present state of agriculture in the locality in which it occurs.

Pheba silt loam.—The soil is a yellowish-gray to light-brown silt loam, 6 to 10 inches deep, underlain by a yellow silt loam subsoil frequently mottled with light gray below 24 inches. The type is derived from the loess, or the yellow loam formation, laid down as a thin deposit over the Eocene lignitic clay. The topography is gently undulating, but on account of the nearness of the heavy underlying clay the drainage is generally insufficient, so that the type is of limited agricultural value.

Scranton silt loam.—The very dark silt loam surface soil of this type is about 6 to 10 inches deep and is underlain by yellow or grayish-yellow silty loam or silty clay, the line of demarcation between the soil and subsoil being less sharp than in the other members of the series. The surface is level or slopes slightly toward drainage channels or areas of the Portsmouth soils. Drainage is deficient. The natural growth is mainly shortleaf pine and wire grass. When cleared and drained it is an excellent soil for corn, wheat, oats, and grasses.

Coxville silt loam.—The soil is a silt loam of light-gray to dark-gray color having a depth of from 5 to 8 inches. The subsoil is a plastic, tough, and impervious clay mottled yellow, reddish-brown, and red. The surface configuration varies from gently rolling to undulating. A few areas occur in slight depressions in which the organic matter content is higher and the color darker. The drainage is rather poor, and the type requires ditching in order to be put in proper condition for cultivation. The type differs from the Portsmouth soil in that it has not been subjected to swampy conditions, and in its average lighter soil color and the more intense mottling and predominance of red colors in the subsoil. Clods are easily formed, unless a good tilth is maintained through deep and timely cultivation. Heavy applications of lime and coarse barnyard manure or green manure are required to improve its structure. Grass, cotton, corn, and forage crops do quite well. Certain varieties of strawberries find the type well suited to their requirements.

Susquehanna silt loam.—The type consists of 5 to 8 inches of brown friable silt loam, underlain by a red mottled heavy clay to a depth of about 30 inches and thence to greater depths by clay of the same texture and of a gray color showing red mottling. The soil contains

a fair amount of humus, works up easily, and does not clod badly. It is confined to rolling uplands and has perfect drainage. Ironstone fragments are found to a slight extent in both soil and subsoil. The areas of this soil are largely under cultivation. Corn, cotton, and oats are the principal products, with Bermuda grass for pasture.

Hyde silt loam.—The soil is a dark-gray to black mellow silt loam high in organic matter, having a depth of 36 inches. The material becomes lighter in color upon drying out. The surface configuration varies from flat to slightly ridgy. The type is well adapted to corn, oats, cotton, and soy beans. In years of normal rainfall the yields of corn range from 30 to 50 bushels, of oats from 30 to 75 bushels, and of cotton two-thirds to 1½ bales per acre. Soy beans yield about 25 bushels per acre. Potatoes, black peas, the Mattamuskeet apple, figs, celery, and late crops of vegetables also do well.

Mattamuskeet silt loam.—The soil is a black mellow silt loam or mucky silt loam from 10 to 24 inches deep. The subsoil is usually a gray to dark-gray loamy fine sand. In places it runs as heavy as fine sandy loam or even silt loam. The content of organic matter is high and when the soil dries out it is very light in weight. The type occurs just above normal water level and is subject to inundation. It is well suited to corn, oats, cotton, onions, cabbage, and soy beans.

THE CLAY LOAM GROUP.

The clay loams of the Atlantic and Gulf Coastal Plains are adapted only to certain of the general farm crops. They are too stiff and too late in maturing crops for profitable utilization in the production of even special-purpose vegetables. The range of adaptation to general farm crops is more restricted than in case of the silt loams. Wheat, oats, and rice do well, and heavy yields of forage crops, such as sorghum and cowpeas, or mixtures of these with corn, are secured. Grass does well, but owing to the restriction of grazing to dry-weather conditions on account of the tendency of such heavy soils to compact when tramped under wet conditions, profitable stock raising and dairying must depend less upon pasturage than in case of lighter soils and must be supplemented with heavy crops of forage for ensilage and soiling.

Good yields of corn are secured under normal conditions of weather and where frequent thorough cultivation is given the crops. The profitableness of cotton farming on these lands depends very considerably upon the earliness of the varieties grown. Where the boll weevil is troublesome the very earliest maturing varieties must be grown, and even with these full crops may not always be had. The soils of this group require a heavy farm equipment.

TABLE XII.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Wilson clay loam	Tex. 3, 9, 10, 21, 24, 28	111,680
Oktibbeha clay loam	Ala. 1; Miss. 2, 8, 10	48,960
Susquehanna clay loam	La. 4; Md. 1, 8	31,826
San Antonio clay loam	Tex. 22	28,608
Crockett clay loam	Tex. 3, 12, 21	21,440
Portsmouth clay loam	Miss. 13; N. C. 20; Va. 12	18,304
Grayson clay loam	Tex. 10	10,560
Houston clay loam	Tex. 10	7,168
Lacasine clay loam	La. 7	3,470
Norfolk clay loam	Va. 12	1,856
Greenville clay loam	Ala. 8	768
Coxville clay loam	N. C. 20	256

[1] For key to numbers in this column, see p. 253.

Wilson clay loam.—The type consists of 6 to 10 inches of a dark-brown to black clay loam, underlain by a compact and tenacious clay, which becomes heavier in texture and lighter in color with depth and at 36 inches is frequently streaked with yellow. This is an upland type, occupying gently rolling stretches or long, gradual slopes. Drainage is usually adequate. The type is locally known as "mesquite flats," and but little is under cultivation, though cotton, corn, oats, and sorghum do well in favorable seasons. The soil has a poor structure and is difficult to handle with the equipment in common use.

Oktibbeha clay loam.—The soil, which is 4 to 6 inches deep, is a dark-brownish friable fine loam or heavy silt loam, usually containing a fair amount of humus. The subsoil is a yellowish-brown silty clay to a depth of 30 to 36 inches, beyond which it becomes lighter in color and gives way to the heavy Lignitic clay. The topography is sufficiently rolling to promote good drainage, and some of the slopes need to be protected from erosion. A thrifty growth of oak, hickory, and pine occurs in wooded areas. About half the type is under cultivation. Cotton, wheat, and oats are the principal crops. It is an excellent cotton soil.

Susquehanna clay loam.—The type is composed of a yellow or brown loam, about 10 inches deep, underlain by a heavy mottled red clay subsoil, identical with Susquehanna clay. The type occupies hills, slopes, and valleys, and is adapted to corn, wheat, oats, and grass. Considerable areas are yet in oak and pine forests. Late summer apples do well.

San Antonio clay loam.—The soil is a brownish or chocolate colored loam or clay loam from 8 to 12 inches deep. As a rule there is no definite line of demarcation between soil and subsoil, either as to texture or color. Below 12 inches and extending to about 24 inches

the subsoil becomes lighter in color and usually somewhat heavier in texture; thence to a depth of 36 inches the color changes to reddish and the texture becomes lighter, the material usually grading into coarse limestone gravel. The soil is derived directly from a limestone formation belonging to the Upper Cretaceous, or from limestone material reworked by ancient floods. The greater part of this type is under cultivation and is very productive. Where irrigated it is excellent for such fruit as is suited to the climate of southwest Texas. The soil is adapted to cotton, corn, and hay, while sorghum and alfalfa are grown with fair success.

Crockett clay loam.—This is a dark-brown or black clay loam from 12 to 18 inches deep, underlain by a mottled drab and red and sometimes yellow clay loam. Both soil and subsoil contain a small proportion of fine rounded gravel or iron concretions and, at a depth of several feet, there occurs a brittle gray material sometimes stratified and having much the same texture as soft soapstone rock. The surface of the type is gently rolling to level and fairly well drained. The soil was probably formed by the weathering of some calcareous material, perhaps an impure limestone. It is best suited to cotton, corn, wheat, oats, and hay. It is also adapted to alfalfa.

Portsmouth clay loam.—The soil is a clay loam of ashy-gray to dark-brown color and about 6 inches deep. It grades abruptly into a dense waxy clay, which extends to a depth of 24 inches. Below 24 inches the subsoil contains pockets of fine sand. The type occupies flat or troughlike depressions along tidewater, and the drainage is inadequate. It is derived from marine deposits. The soil is used for the production of corn, wheat, and grass, of which moderate yields are secured. The yield would be much better if thorough drainage were provided and heavier farm equipment used.

Grayson clay loam.—The type consists of 8 to 10 inches of dark-gray or brown clay loam, underlain to a depth of 3 feet by a stiff yellow, sometimes mottled, clay or silt clay. The surface in general is flat, but with small slightly elevated knolls or ridges scattered over the area. Practically all of the type is uncultivated, mainly on account of the lack of drainage. Occasionally a small area in the more elevated parts is under the plow, but the crops are almost a failure during a wet year. A little alkali is present, but it is noticeable only in small spots. Gypsum crystals are also scattered through the soil and subsoil.

Houston clay loam.—The soil is a heavy grayish-brown loam or clay loam from 8 to 15 inches deep. The subsoil has the same texture, but the color changes gradually from brownish-gray in the upper part to yellowish at a depth of 4 or 5 feet. Often a few small rock fragments occur in both soil and subsoil, but where the development is typical the underlying rock lies at a great depth and no fragments

are found. This is a residual type derived from the weathering of a white limestone or chalk. The soil is friable and easily worked and retains moisture well. It occurs in the gently rolling prairie and has excellent drainage. It is closely associated with the Houston black clay, but is not so stiff and waxy and is sometimes found at higher elevations. It is a good soil for cotton, corn, and sorghum, and when irrigated is well adapted to truck farming and to such fruits as are suited to the climate.

Lacasine clay loam.—The type consists of a heavy brown or black clay loam 20 inches deep, grading into a mottled clay subsoil, containing considerable silt, varying quantities of iron nodules, and sometimes lime concretions. The type is found in depressions in large swamp areas free from hummocks. The soil is heavy, difficult to till, and poorly drained, but has properties which would make it a durable type. In its present state is has no agricultural importance and as it is of small extent it is doubtful if it would be worth improving.

Norfolk clay loam.—The type consists of about 6 inches of dark-brown clay loam, underlain by a very dense waxy clay of a dark reddish brown color. At about 24 inches thin lenses of very fine sand occur, and the color changes to a mottled grayish blue. The surface is flat and the elevation is only about 10 feet above sea level. Much of the type is imperfectly drained. It is best adapted to grass and small grains and formerly produced moderate yields of wheat. Drainage is required to put this soil in good condition.

Greenville clay loam. The surface soil, with a depth of 3 to 5 inches, is a dark-brown to reddish-brown heavy sandy loam to clay loam. The subsoil is a deep red sandy clay. Under cultivation the type acts like a clay loam, requiring careful handling for the maintenance of good structural conditions. In spots the clay subsoil has been exposed through the action of erosion. Such "galls" are generally covered on the surface with small iron concretions. The surface configuration in the main is undulating, with some areas very flat, others gently rolling. Where the rolling topography is found erosion is most noticeable. The surface drainage over most of the type is excellent. This soil is well adapted to cotton, although under average treatment the yield ranges from one-half to 1 bale per acre. With proper management yields between 1 and 2 bales per acre should be secured. Corn, oats, and forage crops do very well.

Coxville clay loam.—The soil to a depth of 4 to 8 inches consists of a dark-gray to black plastic clay loam. The subsoil is a grayish stiff plastic clay mottled with brick-red, drab, and other colors. It occupies flat, slightly depressed areas, having poor drainage. If well drained, this soil would produce good yields of oats and corn.

BLACK CLAY LOAM PHASE.

The black loam phase is relatively small, and for this reason is of minor importance, though the phase itself forms a very fine agricultural soil. It consists entirely of one type, the Houston black clay loam, which up to this time has been mapped only in places.

TABLE XIII.—*Area and distribution of the Houston black clay loam.*

Name of soil.	State and area.[1]	Acres.
Houston black clay loam	Tex. 22	54,272

[1] For key to numbers in this column, see p. 253.

Houston black clay loam.—The soil is a heavy grayish-brown clay loam from 8 to 15 inches deep. The subsoil has the same texture, but the color changes gradually from brownish-gray to yellowish at a depth of 4 or 5 feet. Often a few small rock fragments occur in both soil and subsoil, but where the development is typical the underlying rock lies at a great depth and no fragments are found within the profile. This is a residual type, derived from the weathering of limestone or chalk. The soil is friable and easily worked and retains moisture well. The type occurs on the gently rolling prairies and has excellent drainage. It is closely associated with the Houston black clay, but is not so stiff and waxy and is sometimes found in higher locations. It is a fine soil for cotton, corn, and sorghum, and, when irrigated, as it frequently is in Texas, is well adapted to truck farming and to such fruits as are suited to the climate. It is especially adapted to alfalfa.

THE CLAY GROUP.

The clay soils of the Atlantic and Gulf Coastal Plains are adapted to the production of heavy special farm crops, such as mixtures of corn, sorghum, millet, or other of the coarser forage crops for ensilage or dry winter feed. Wheat, rice, and grass do well. Cultivation is so difficult and is limited to such a narrow range of moisture conditions that the production of corn for the grain gives unsatisfactory results from the viewpoint of profitableness. The early maturing varieties of cotton under intensive cultivation and outside of boll weevil infested districts give fairly profitable returns—somewhat lower than those obtained from clay loams. Complete failures may be expected occasionally when the crop is grown in sections where the boll weevil is plentiful.

Grazing is restricted to even narrower limits than on the clay loams, owing to rapid deterioration of the sod when tramped or closely grazed for any considerable time. Successful stock raising

and dairying on the clays, therefore, depend mainly upon the production of heavy crops of ensilage, coarse forage, and hay.

The heaviest kind of farm equipment is required to bring out and provide for the highest efficiency of these soils, and it is because of the lack of adequate equipment throughout the province and the relatively small area covered by the soils of this group that they have generally been held in low esteem and often entirely neglected.

TABLE XIV.—*Area and distribution of the clays.*

Name of soil.	State and area.[1]	Acres.
Houston clay	Ala. 1, 5, 11, 14, 21, 24, 25, 26; Kan. 6; La. 12; Miss. 2, 6, 8, 10, 11, 12; Tex. 2, 9, 10, 22, 23, 26.	799,144
Orangeburg clay	Ala. 1, 5, 11, 21, 25, 26; Ga. 5; Miss. 6, 8, 10, 11; S. C. 13; Tex. 1, 12, 13, 15, 19, 20, 22.	478,976
Susquehanna clay	Ala. 2, 3, 5, 15, 21, 24; La. 2, 3, 8, 12; Md. 3, 5, 8; Miss. 6, 10; Tex. 9, 10, 11, 12, 18, 24.	416,234
Lufkin clay	Ala. 26; La. 3, 10; Miss. 2, 3, 8, 10, 11; Tex. 1, 7, 11, 12, 17, 19, 20, 21, 29.	386,880
Victoria clay	Tex. 8	165,184
Wilson clay	Tex. 10	100,864
Oktibbeha clay	Ala. 14; Miss. 2, 8, 10, 12	83,136
Montrose clay	Miss. 6	43,840
Lomalta clay	Tex. 5, 8	41,344
Alloway clay	N. J. 1, 2	22,484
Portsmouth clay	N. C. 17	16,512
Morse clay	Ark. 4; La. 1	7,424
Coxville clay	S. C. 6	6,656
Point Isabel clay	Tex. 5	4,096
Mobile clay	Ala. 23	896
Greenville clay	Fla. 6	768

[1] For key to numbers in this column, see p. 253.

Houston clay.—The type consists of a gray to brown or black loamy clay 4 to 10 inches deep, resting on a stiff, lighter colored clay subsoil passing at about 20 inches into a light-gray or white rotten limestone or chalk. The color of the soil varies somewhat according to topographic position, the darker colored areas occupying the depressions and more level situation, while the white subsoil is often exposed along slopes giving rise to irregular spots resembling "galls." The soil is friable and easily cultivated under proper moisture conditions, but is extremely plastic and sticky when wet. Areas not under cultivation bake and sun-crack upon drying. The type occupies level to gently rolling country, usually prairie, and is derived from rotten limestone or chalk of Cretaceous age. Cotton is the principal product, but the soil produces good yields of corn, oats, hay, and legumes. It is one of the best alfalfa soils of the province.

Orangeburg clay.—The type is composed of a red loam or clay loam with an average depth of 8 inches resting on a stiff, tenacious,

reddish-brown or red clay subsoil. In small local areas a sandy covering is sometimes found, but the red clay is always within 4 inches of the surface. Generally the surface is rolling or hilly and the drainage is excellent. The native forest growth is hardwood. Cotton and corn are the principal crops, the former yielding from one-third to 1 bale and the latter from 15 to 45 bushels per acre, according to the thoroughness of cultivation. It is not so good for oats, but is good for hay if efficiently handled. It is adapted to the Cuban type of cigar-filler tobacco in areas from Alabama west to Texas.

Susquehanna clay.—The type consists of a clay loam or clay 6 inches deep, sometimes containing gravel, overlying a stiff, tenacious, red and mottled pipe-clay subsoil. It occupies hills and rolling land on the inner border of the Coastal Plain region. The soil is very refractory and hard to cultivate. At present it has little agricultural value. It is possible, though expensive, to make it produce large yields of the heavy farm crops, especially hay, forage, and ensilage crops.

Lufkin clay.—The soil is a loam or silty loam from 3 to 8 inches deep, containing occasionally a few iron concretions. The subsoil is a stiff, impervious drab or mottled gray and yellow clay. At a depth of 3 to 5 feet the clay is often distinctly stratified. The surface is generally level and drainage is poor. The natural forest growth consists of scrubby pine and oak. The soil is not well adapted to ordinary farm crops, and small yields of corn and cotton are obtained under prevailing methods of cultivation, but can be improved and brought into place, so far as its use for the heavier crops is concerned, when this is desired.

Victoria clay.—The soil to an average depth of 10 inches consists of a dark-brown to black clay loam. This material is underlain by a compact calcareous clay loam or clay lighter in color than the soil and often containing small lime concretions. At depths ranging from 2 to 5 feet the subsoil usually becomes slate colored. When dry the soil of uncultivated fields bakes and cracks, and when wet it is very sticky and tenacious. It is derived from calacareous clays of Tertiary age. The surface is level to gently undulating and the drainage is fair. In its natural condition the soil is largely covered with mesquite and cactus. When well cultivated it is excellent for the heavy farm crops and for alfalfa.

Wilson clay.—The surface soil consists of 10 to 15 inches of very heavy clay, varying in color from a dull-yellow to dark-brown or almost black. The subsoil is very similar to the soil in texture, but somewhat more tenacious. As it contains a lower percentage of organic matter, the color is lighter. Partially decomposed lime concretions are scattered through the soil and subsoil, more being found in the subsoil. The intermingling of dull yellow and darker-colored

areas in the fields is very noticeable along the slopes, the fields appearing to be striped alternately with yellow and darker colors, the stripes extending up and down the slopes. This is very plastic soil when wet, but cracks badly upon drying. The topography varies from rolling to level. The drainage, in seasons of normal rainfall, is good. The type is adapted to cotton, corn, and grain. It seems especially adapted to oats.

Oktibbeha clay.—The type consists of a heavy yellowish-brown sandy clay with a depth of 3 feet or more, beyond which the material becomes mottled. The topography is rolling to hilly and the heavy character of soil does not permit rapid absorption of the rainfall, consequently the run-off is excessive and erosion very active. The type is largely the result of wash in areas which were once Oktibbeha fine sandy loam, the fine sand covering having been removed. Most of it has been cleared, but very little is now under cultivation. It is largely devoted to pasture or allowed to grow up in scrub pine, oak, and wild plum. Cotton is the principal crop, but the yields are comparatively light. The reason for the low esteem in which the soil is held is apparent from the description. The remedy, when the time arrives to apply it, is more intensive culture and specially of heavier farm crops. For the present it is better left in forest.

Montrose clay.—The type consists of a grayish-drab clay with a depth of 2 to 6 inches, underlain by a yellow or yellow and gray very plastic clay, which becomes mottled red and yellow below 20 inches. The subsoil is very heavy and has a somewhat greasy feel when wet. The type of soil occupies flat, poorly drained areas and is locally called "hog wallow prairie." On account of its low humus and high clay content it is difficult to cultivate. It is almost all timbered with scrawny post and black-jack oak, with some shortleaf pine. The requirements for bringing out the highest efficiency of this soil are obvious from the description. It is simply not adapted to the type of agriculture prevailing in the locality at the present time.

Lomalta clay.—This type consists of 12 to 15 inches of dark-drab to black clay or silty clay which grades rapidly into a light-brown to reddish-brown silty clay subsoil. The soil puddles and bakes badly. Beds of crystalline gypsum and lime concretions occur in the subsoil. The surface is nearly level and low lying, so that overflows are frequent. A considerable quantity of alkali is present in both soil and subsoil and drainage facilities are so poor that the reclamation of the land for agricultural purposes would be difficult.

Alloway clay.—The type consists of a red or gray clay loam, 6 inches deep, containing some gravel, underlain by a mottled yellow and gray sticky clay subsoil, extending to a depth of 3 feet or more. The type occupies rolling upland or bottoms. It is a good grass and

wheat soil and produces fine apples. The soil is difficult to till and is generally in need of underdrainage.

Portsmouth clay.—The soil is a dark-gray to black silty loam to clay loam ranging in depth from a few inches to about 8 inches. The soil material is usually heavier and more compact in the higher, better drained, situations. In the wet or semiswampy areas the soil is generally a dark-gray to black smooth silty loam from 10 to 14 inches deep. The subsoil is a stiff impervious clay, mottled gray and yellow, or drab, yellow, and reddish yellow. The type occurs on poorly drained flat uplands and in drainage ways or other depressions. The timber consists largely of bay, scrubby sweet gum, and pine, with an undergrowth of gallberry and other shrubs. The soil requires heavy applications of lime for best results. When well drained corn, forage crops, and oats are produced with considerable success.

Morse clay.—The soil consists of a heavy silt or clay loam 6 to 8 inches deep. The subsoil is a heavy mottled clay. Both soil and subsoil are highly calcareous. The type occurs along stream courses and generally has good drainage. It is a very unimportant soil, difficult to till, and little under cultivation. It is adapted to rice where irrigation is possible and in the well-drained areas is fairly well adapted to corn and cotton.

Coxville clay.—The soil consists of a dark-gray to black fine sandy loam to loam with an average depth of about 4 inches. The loam phase is usually darker in color and is confined largely to slight depressions. The subsoil is a drab plastic clay with yellow and red mottlings. The plasticity increases and the red mottling becomes more brilliant and pronounced with increase in depth. The type occurs as flat savanna lands. It has poor surface drainage and is watersoaked during the greater part of the year. In droughts the surface bakes and cracks. Very little of the type is under cultivation. If given good surface drainage by ditching, plowed deep, limed, and well supplied with organic matter, fine crops of cotton, oats, corn, and strawberries could be grown. Plowing must be done when the soil is in proper condition with respect to moisture, for if plowed too wet it is apt to clod.

Point Isabel clay.—The soil is a heavy drab to brown clay, 10 to 15 inches deep. The subsoil is lighter colored, but of the same texture as the soil. The type does not bake badly. It occupies long, narrow ridges or beaches, the tops of which are narrow and level and the slopes steep and abrupt, allowing excessive drainage. These beaches were formed by wave action when salt water occupied the basins below. It is of little agricultural value.

Mobile clay.—The type consists of a yellow loam, with an average depth of 8 inches, resting on a stiff plastic yellow clay or sandy clay subsoil, which extends to a depth of 3 feet or more. The soil is

characterized by the presence of many iron concretions and is usually found overlying the materials forming the Orangeburg sandy loam. The surface is flat and marked by numerous swampy, pondlike depressions covered by a scrubby growth of gum. The drainage is generally poor. The soil is best adapted to grain and grass.

Greenville clay.—This type of soil consists of not more than 6 inches of red or chocolate-red clay or heavy clay loam resting upon a heavy, stiff, tenacious red, yellowish-brown to reddish-yellow clay. The type occupies ridges and knolls. It is derived from weathering of Vicksburg limestone, which frequently outcrops. Weathered fragments of various sizes frequently occur upon the surface. This is recognized as a strong soil for general agriculture, but is very difficult to cultivate.

GRAVELLY CLAY PHASE.

The gravelly clay phase in this province is represented by one soil, the Houston gravelly clay. This has been mapped so far only in Texas, where it has been found in five different areas.

TABLE XV.—*Area and distribution of the Houston gravelly clay.*

Name of soil.	State and area.[1]	Acres.
Houston gravelly clay	Tex. 2, 3, 22, 23, 26	148,416

[1] For key to numbers in this column, see p. 253.

Houston gravelly clay.—The soil is a heavy, dark-brown to black clay loam or clay 12 inches deep, containing a large amount of gravel and rounded, waterworn pebbles, varying in size from one-eighth of an inch to 3 inches in diameter. The subsoil is a light-brown stiff clay which becomes stiffer as the depth increases. The subsoil usually contains a small percentage of rounded gravel, although there are small areas where it is a bed of porous gravel. The type occupies the higher ridges of the rolling prairie and is easily eroded. The gravel is derived from the remains of an old formation which has been almost entirely worn away, leaving only a thin layer capping the higher ridges. Owing to its topography and gravelly character the type has good drainage. The crops grown are cotton, corn, sorghum, oats, and some Kafir corn, and good yields may usually be obtained.

BLACK CLAY PHASE.

While treated as a variation from the typical clays, the black clay phase is, nevertheless, a very important agricultural asset. It is represented also by a single soil type, but this type occurs exten-

sively in Texas, as well as in Alabama and Oklahoma, as will be seen in the following table:

TABLE XVI.—*Area and distribution of the Houston black clay.*

Name of soil.	State and area.[1]	Acres.
Houston black clay	Ala. 26; Okla. 2; Tex. 1, 2, 3, 4, 7, 10, 12, 15, 16, 20, 22, 23, 26, 27.	1,402,392

[1] For key to numbers in this column, see p. 253.

Houston black clay.—The soil is a black or sometimes drab clay about 10 inches deep, friable when well cultivated, but becoming waxy and sticky when wet and, if not continually cultivated, caking into a very hard and compact mass that cracks into irregular blocks on drying. The subsoil is a waxy, very stiff, and tenacious clay of lighter color than the soil. Both soil and subsoil contain varying quantities of lime concretions. The type is derived from the weathering of soft limestone or calcareous clays, for the most part of Cretaceous age. The soil is very productive and is used commonly for corn, cotton, and rice, according to locality, elevation, and drainage, and is adapted also to grass and alfalfa.

SOILS OF SUBORDINATE VALUE.

The following types of soils, which are properly phases of the above groups, by reason of their very open structure or rough, hilly topography, depart so widely from the group characteristics as regards crop adaptations and crop yields that they can not in most cases be improved or raised in any economical way to the group efficiency. They are, therefore, of decidedly subordinate value in the general agricultural development of the country. Locally they may offer important and difficult problems to the owner of farms upon which the several types may be found. Full descriptions of each type are, therefore, given as in the case of the more productive soils, and so far as possible the uses of the soils are mentioned without, however, going into the question of the expense involved in fitting the land for the suggested use. In the present state of agriculture the development of these soils can very properly be left for future necessities, in the meantime using them as far as practicable for forest products and for grazing.

GRAVELS.

TABLE XVII.—*Area and distribution of the gravels.*

Name of soil.	State and area.[1]	Acres.
Norfolk gravel	Md. 2, 3, 5, 6, 8, 9; N. J. 2; N. C. 18	135,342
Susquehanna gravel	N. Y. 6; Tex. 3, 23, 28	61,888

[1] For key to numbers in this column, see p. 253.

Norfolk gravel.—The soil occurs as hills, narrow bands, or outcrops of gravel consisting of 30 to 60 per cent of rounded water-worn gravel with interstitial material varying from sand to sandy loam or loam. The subsoil is usually a gravelly sand or sandy loam, but locally consists of stiffer and more clayey material. The type is formed through denudation of gravel layers deposited as shallow-water sediment or as river wash or delta. It is a poor unproductive soil, generally occupying slopes, and should remain in forest.

Susquehanna gravel.—The soil, to a depth of 6 to 20 inches, consists of sand, gravel, cobblestones, and a noticeable quantity of the finer grades of material all intimately mingled. The subsoil is generally a heavy red or mottled sandy clay. Beds of gravel may occur from 2 to 20 feet below the surface. The type occurs in the vicinity of the junction of bottom lands with uplands and is usually rough and hilly. It has a natural growth of hardwood, mostly black-jack oak and post oak with some pine. It is valued chiefly for its timber.

GRAVELLY SANDY LOAMS.

TABLE XVIII.—*Area and distribution of the gravelly sandy loams.*

Name of soil.	State and area.[1]	Acres.
Greenville gravelly sandy loam	La. 2, 8, 12	191,040
Guin gravelly sandy loam	Ala. 1, 3, 18, 22	155,072
Orangeburg gravelly sandy loam	Ala. 3, 14, 15, 28; Tex. 21	68,992
Webb gravelly sandy loam	Tex. 14	53,760
Chesterfield gravelly sandy loam	Va. 5	34,304
Norfolk gravelly sandy loam	Ala. 15, 28	14,336
Collington gravelly sandy loam	Md. 1	320

[1] For key to numbers in this column, see p. 253.

Greenville gravelly sandy loam.—The soil, which has an average depth of about 10 inches, varies from gray to reddish fine sandy loam. The subsoil, to a depth of 3 feet and often more, is usually a bright-red sandy gravelly clay, though the material sometimes becomes mottled at 3 feet. The surface of the ground is usually strewn with small ferruginous concretions of argillaceous and arenaceous material, which gives rise to the term "gravelly land." This gravel is also found in both soil and subsoil, and upon the hills large pieces of sandstone and iron crusts sometimes occur. The type is found on rolling and hilly areas and has excellent drainage. In favorable localities early truck, peaches, and small fruit may produce fairly well, and rather poor crops of corn and cotton are secured. This is probably the most important of the gravelly sandy loam soils.

Guin gravelly sandy loam.—The soil, from 8 to 10 inches in depth, is a light-brown or gray sandy loam. The subsoil has about the

same texture and usually a yellow or gray color. Both soil and subsoil contain a large quantity of waterworn gravel. The surface is rather broken, and erosion and drought are likely to occur. Areas of this soil are largely covered with oak forests. Under cultivation the humus is rapidly depleted, and unremunerative yields of cotton are obtained. The type had best be kept in forest.

Orangeburg gravelly sandy loam.—The soil, to a depth of about 10 inches, consists of a reddish-brown sandy loam, carrying from 15 to 40 per cent of iron concretions and quartz gravel. The depth of surface material often varies, ranging from a few inches on the upper slopes to 20 inches in lower locations. A few rock fragments are sometimes present on the surface of steep slopes. The subsoil is red or dark red in color and is considerably heavier than the soil. Areas of this soil are found on low hills and ridges and are well drained. They are not desirable for general farming, but afford fairly good opportunities for the production of early vegetables.

Webb gravelly sandy loam.—The soil consists of a light-brown to reddish-brown fine sandy loam, carrying a large quantity of rounded, waterworn gravel. The soil has an average depth of about 10 inches, but on the steep hillsides the fine sandy loam is easily eroded and is seldom more than a few inches deep. Where this fine material is washed down to lower levels the rounded gravel left on the steep slopes frequently covers from 40 to 60 per cent of the surface. The subsoil consists of a very sandy clay, brown to reddish brown in color. Though containing a relatively large percentage of sand, it is sticky and tenacious when wet, and in small areas on some of the steeper slopes, where it has been exposed by erosion, it bakes and sun-cracks and has the general appearance of a much more clayey material. The type is rolling in topography. It is not well suited to agriculture. The gravelly texture and rolling topography make it better adapted to the growing of fruit than to the production of any crops which require frequent cultivation. It is essentially a forest soil.

Chesterfield gravelly sandy loam.—This type, to a depth of 6 inches, is a dark-gray or brownish-gray gravelly sandy loam, and occasionally, where the sand content is low, a gravelly loam. Below this surface soil, and extending to a depth of from 10 to 12 inches, is a lighter colored material having practically the same texture, although it contains less organic matter and on this account is not quite so loamy. The subsoil, to a depth of 36 inches, is usually a yellowish gravelly clay, but sometimes changes to a stiff red clay. The greater part of the type has such a high gravel content that it is very difficult to make borings 3 feet deep. The type is generally found near stream courses, although it occurs as narrow strips or ridges in the interstream areas. Its topography is rolling and broken, and the slopes of the greater part of it are sufficiently steep to prohibit culti-

vation. Practically none of it is farmed. The forest growth consists principally of hardwoods, such as white oak, post oak, red oak, with some hickory and a scattering of pine.

Norfolk gravelly sandy loam.—The soil is a grayish colored gravelly sandy loam from 10 to 15 inches deep. The sand particles range mainly from coarse to fine, forming a matrix in which rounded, waterworn quartzite and quartz pebbles are generally evenly mixed. As much as 50 per cent of gravel is found in the soil, while varying quantities are strewn upon the surface. The subsoil is a yellow sandy clay, also containing varying quantities of quartz and quartzite gravel. The type occurs as rounded ridges on slopes and in gently rolling areas usually of small extent. It is so open in structure that crops are liable to suffer severely from drought. The yields of all crops are low. Some cotton and corn is grown. Early vegetables may be grown to some advantage on those areas topographically suited to cultivation.

Collington gravelly sandy loam.—The soil is a grayish-brown to reddish-brown medium sand to light sandy loam from 10 to 15 inches deep. The subsoil is a greenish-yellow to reddish-yellow sandy loam or sandy clay. Quartz gravel, ironstone fragments, and glauconite sand are conspicuous throughout the soil mass. The type occupies steep and usually badly eroded areas. The rough topography makes cultivation rather difficult, on which account, coupled with its too open structure, it is not considered a very desirable soil and should be held in forest.

STONY SANDY LOAM.

TABLE XIX.—*Area and distribution of the stony sandy loam.*

Name of soil.	State and area.[1]	Acres.
Guin stony sandy loam	Ala. 18, 22	111,552

[1] For key to numbers in this column, see p. 253.

Guin stony sandy loam.—This type differs from the Guin fine sandy loam only in having large quantities of iron crust and gravel conglomerate on the surface, and in forming country with a rough, broken topography. It occurs around the heads of streams and on steep narrow ridges subject to erosion. Little of it has been cleared of the oak, hickory, and pine timber forest which form the characteristic vegetation.

GRAVELLY SAND.

TABLE XX.—*Area and distribution of the gravelly sand.*

Name of soil.	State and area.[1]	Acres.
Norfolk gravelly sand	Ala. 2	25,152

[1] For key to number in this column, see p. 253.

Norfolk gravelly sand.—The soil consists of dull gray medium sand carrying considerable rounded, light-colored quartz pebbles. At a depth of 1 or 2 feet the material is less weathered and the color ranges from yellowish to brown. Otherwise the subsoil is quite similar to the soil, consisting chiefly of medium and coarse sand with gravel scattered through it. The type occupies mainly slopes and ridges. Its agricultural value is very low.

GRAVELLY LOAMS.

TABLE XXI.—*Area and distribution of the gravelly loams.*

Name of soil.	State and area.[1]	Acres.
Susquehanna gravelly loam	Ala. 3, 14, 24; La. 8; Md. 1; N. C. 18; Tex. 6, 18, 24	204,538
Sassafras gravelly loam	Md. 1, 4, 6; N. J. 1, 2; N. Y. 6	164,678
Norfolk gravelly loam	Ala. 20, 21, 24; Miss. 3, 4; Pa. 6, 7; Va. 6	158,086
Glenn gravelly loam	Ala. 9	69,312
Lufkin gravelly loam	Tex. 3, 15	58,112
Crockett gravelly loam	Tex. 21	3,008

[1] For key to numbers in this column, see p. 253.

Susquehanna gravelly loam.—The soil is a grayish-brown sandy loam, medium to fine in texture, containing 40 to 60 per cent of rock fragments and gravel, mainly iron sandstone. At a depth of 6 to 15 inches the surface material rests upon a red, occasionally mottled, tenacious clay subsoil, which also contains sand, gravel, and stones. The type is found as broken areas along streams and hills. Tillage is difficult. Poor crops of cotton and corn can be grown with the use of fertilizers. It would much better be left in forest.

Sassafras gravelly loam.—This type consists of a brown or yellowish-brown loam, disseminated through which is from 10 to 25 per cent of medium-sized rounded quartz gravel. The subsoil is a reddish-colored material, considerably heavier than the soil. The type occurs as narrow strips along stream slopes or as small patches on upland slopes. Its formation is due to removal of the finer soil material by wash, leaving behind or exposing an underlying gravelly material. The drainage is excellent. Where not too steep it is fairly well adapted to wheat, corn, grass, clover, and forage crops. It is also, for a soil of its class, quite well suited to tomatoes.

Norfolk gravelly loam.—The soil is a gray sandy loam, from 6 to 30 inches deep, containing relatively large proportions of coarse to medium sand and from 15 to 50 per cent of gravel and iron concretions. The subsoil ranges from a sticky sandy loam to a light sandy clay, with an admixture of varying quantities of gravel. The gravel generally is mixed evenly throughout soil and subsoil, but occasionally covers the surface. This type occupies terraces and gently to steeply rolling plains marked with occasional ridges and hills. The surface configuration, combined with open texture, gives the type excellent drainage. It supports a scattered growth of oak and pine. Corn, cotton, rye, buckwheat, truck crops, peaches, and wrapper tobacco are grown, according to the locality, but the yields are very low. It is far better to leave the soil in forest than to use it for cultivated crops.

Glenn gravelly loam.—The type consists of a gray silt loam, from 6 to 8 inches deep, overlying a gray to reddish-brown silty clay. Both soil and subsoil contain a considerable quantity of rounded and subangular quartz and chert gravel, together with fragments of ironstone and conglomerate. The surface is very hilly and broken and drainage excessive. Most of the type is too sterile and droughty for profitable agriculture, and is better adapted to forestry.

Lufkin gravelly loam.—The soil is usually a gray fine sand, though in depressed areas it is sometimes considerably heavier. The subsoil is a heavy sandy clay, varying much in color. Both the soil and the subsoil contain large quantities of gravel. The surface is generally rough and hilly and the drainage excessive. The type is largely in pasture. Yields of about one-third bale of cotton and 15 bushels of corn per acre are secured on some of the less gravelly areas.

Crockett gravelly loam.—The soil consists of a yellowish-brown fine sandy loam, or loam containing from 15 to 60 per cent of quartz and ferruginous sandstone gravel, with a depth of about 8 inches. The subsoil is comparatively free from gravel, and to a depth of 36 inches consists of a yellowish, very stiff, plastic, slightly sandy clay. The type has a gently rolling surface and is well drained. It is sparsely timbered and little in cultivation. It may be used for early truck crops, like garden peas, lettuce, and radishes, and for blackberries and dewberries, but is not a desirable soil for this or for any agricultural purpose.

STONY LOAM.

TABLE XXII.—*Area and distribution of the stony loam.*

Name of soil.	State and area.[1]	Acres.
Susquehanna stony loam	Tex. 6	1,024

[1] For key to number in this column, see p. 253.

Susquehanna stony loam.—The Susquehanna stony loam consists typically of a gray or reddish-gray sandy loam, 6 to 12 inches deep, in which occurs a large number of stones of various sizes consisting largely of ferruginous sandstones. The subsoil is somewhat higher in clay content, often assumes a red color, and generally carries a greater proportion of stony fragments than the soil. It occupies rough, hilly districts or occurs as eroded spots in bodies of the Susquehanna gravelly loam. It is generally uncultivated and is utilized only for grazing or forestry purposes. The native timber consists of shortleaf pine, white and post oak, black-jack oak, and hickory.

COARSE SANDS.

TABLE XXIII.—*Area and distribution of the coarse sands.*

Name of soil.	State and area.[1]	Acres.
Norfolk coarse sand	Ala. 20, 21; Fla. 6; Ga. 4, 12; Md. 2, 8, 9; Miss. 6; N. J. 1, 2; N. C. 5, 20; S. C. 13.	286,850
Orangeburg coarse sand	Fla. 6	13,632

[1] For key to numbers in this column, see p. 253.

This is the lightest grade of soil for truck or early vegetables, but is not well adapted for such use, as it is too open and porous. To correct this deficiency to a degree that would enable the production of even moderate yields would involve too much expense under present economic conditions.

Norfolk coarse sand.—The type consists of a loose, incoherent, gray, coarse sand, 8 inches deep, containing 10 per cent or more of gravel, underlain by a subsoil of the same material frequently containing iron crusts. It occurs as level plains or broken slopes and is not very productive, though used to some extent for tobacco, peaches, and truck.

Orangeburg coarse sand.—The soil is a slightly loamy gray coarse to medium sand from 8 to 15 inches deep, frequently containing quartz pebbles and iron concretions. The subsoil is a lighter colored red sand of similar texture, sometimes slightly sticky in the lower depths. The type occurs as level to rolling country, and also as terraces. On account of its open, porous nature crops not infrequently suffer during seasons of moderate rainfall. The timber growth comprises oak, hickory, dogwood, sweet gum, and pine.

MISCELLANEOUS MATERIALS.

The materials included under this heading are not, in their original state, arable soils, as a part of them can not be made into arable soil. Some, however, by extensive and costly reclamation work can

be reclaimed and made to produce more or less bountiful crops. This will be indicated specifically in the following paragraphs.

TABLE XXIV.—*Area and distribution of the miscellaneous materials.*

Name of material.	State and area.[1]	Acres.
Tidal marsh	Ala. 2; Del. 1; La. 9; Md. 1, 4, 10; Miss. 13; N. Y. 6; N. C. 15; S. C. 4; Tex. 4; Va. 12.	306,112
Sandhill	Ala. 2; Fla. 1, 4, 5, ; Ga. 12, 13; N. C. 15, 18, 19; S. C. 6, 7, 9, 11, 13; Tex. 23.	149,960
Peat	La. 11; N. C. 13	76,800
Coastal beach	Ala. 2; Del. 1; Fla. 1; Md. 10; N. Y. 6; N. C. 15; S. C. 4; Tex. 4, 8; Va. 10, 12.	68,288
Muck	Fla. 3; Miss. 13; N. C. 13, 17, 18	37,078
Houston chalk	Ala. 1; Miss. 2, 8, 10	13,632
Rough stony land	Tex. 18	832
Rock outcrop	Fla. 6	384

[1] For key to numbers in this column, see p. 253.

Tidal marsh.—The material varies from dark oozy sediments, interspersed with coarse marsh-grass roots, to a yellowish or dark colored clay, and at depths varying from 2 to 4 feet it rests upon a still heavier clay. Calcareous nodules are sometimes present. This material is extensively developed along the seacoast and along streams subject to tidal overflow. The vegetation consists of salt grass, which affords poor pasturage. The areas must be diked and drained before reclamation is possible, but when so reclaimed and the excess of salt removed, the soil becomes exceedingly productive, especially for corn, cabbage, onions, rice, potatoes, and hay.

Sandhill.—This term is used to describe ridged and uneven areas of sand not in motion, either on account of partial consolidation or because of the sand being fixed by a natural growth of trees or grasses. Such areas sometimes represent old shore lines of the oceans or large lakes and are sometimes formed by river action and by wind. The material is incoherent and is generally so thoroughly drained as to be of little agricultural value. Included valleys and low areas, where organic matter and sufficient moisture are present, are capable of producing fair crops of vegetables.

Peat.—The type is composed of vegetable matter, consisting of roots, stems, fibers, moss, etc., in various stages of decomposition. It occurs as turf or bog, usually in low situation, and always more or less saturated with water. It represents an advanced stage of swamp, with drainage partially established. When properly drained peat becomes a valuable soil for special crops.

Coastal beach.—This is a light-gray or white fine to coarse textured, loose, incoherent sand 3 feet or more in depth, containing varying quantities of shell fragments. It occurs as beaches, narrow

ridges, and islands along the seacoast, and its surface varies from smooth to irregular. At the higher elevations it is modified by wind action. It is not adapted to agriculture.

Muck.—This type consists of more or less thoroughly decomposed black vegetable mold, from 1 to 3 or more feet in depth and occupying low, damp places, with little or no natural drainage. Muck may be considered an advanced stage of peat, brought about by the more complete decomposition of the vegetable fiber and the addition of mineral matter through deposition by water or wind, resulting in a finer texture and closer structure. When drained, muck is very productive and well adapted to corn, potatoes, cabbage, onions, celery, peppermint, and similar crops.

Houston chalk.—This includes exposures of Selma chalk formation in badly eroded areas, where little or no soil has accumulated. The surface few inches varies from the bare, partially weathered white chalk to a light-gray or gray chalky loam, depending upon whether erosion is still going on or not. Below this is a white or yellowish-white, partially weathered chalk, which usually extends to a depth of 3 feet or more. Occasional outcrops of blue rock occur. The land is mainly valuable for pasture.

Rough stony land.—Under this heading have been classed areas so stony and broken as to be nonarable, although supporting forest growth and affording some pasturage. These areas frequently consist of steep mountain ridges, bluffs, or narrow strips extending through definite soil types. These areas differ from rock outcrop in that they support vegetation of economic value and from the stony loams in being nonarable.

Rock outcrop.—This term is used to designate areas consisting of rock ridges, exposed rock outcrops, or accumulations of stone entirely unfit for cultivation and incapable of becoming agricultural land.

SUMMARY.

The soils of this province are essentially special-purpose soils adapted under intensive culture to early fresh vegetables for the northern markets, of which this province has a clear monopoly for six months, from January to the last of June. About two-thirds of the region is composed of soils which are either adapted to this industry or which should be improved with this purpose in view. The continuous supply of vegetables is maintained through the season with advancing climate from south to north and on soils of increasing heaviness of texture.

Of the total area surveyed, there are 1,810,998 acres, or 5.6 per cent, of gravel, stony sandy loam, stony loam, gravelly sandy loam, and gravelly loam, which have small value for agriculture and should be kept in forest. There are 653,086 acres, or 2.0 per cent, of miscel-

laneous materials, which form either waste land or can be used only for forestry until very extensive and costly reclamation work shall be done. This takes 7.6 per cent of the area out of immediate consideration for agricultural use.

There are 3,797,998 acres, or 11.4 per cent of the area, covered with sand (including coarse sand) adapted to the very earliest or extra early vegetables, especially turnips, radishes, lettuce, peas, string beans, Irish potatoes, beets, cucumbers, watermelons, and cantaloupes for the earliest markets.

There are 2,790,064 acres, or 8.5 per cent, of fine sand (including loamy sand) adapted to early crops of the above-mentioned products maturing about two weeks later, and especially to early crops of squash, peppers, sweet potatoes, okra, tomatoes, lima beans, spinach, and cabbage, which are commonly referred to as the heavier truck crops.

There are 4,762,774 acres, or 14.6 per cent, of sandy loam (including coarse sandy loam) which is adapted to vegetables maturing for market at a medium period, and on which the lightest type of general farming may be practiced with early crops and light yields.

There are 10,746,864 acres, or 32.9 per cent, of fine sandy loam (including very fine sandy loam) which may be used for vegetables for a medium late spring market and for a light type of general farming.

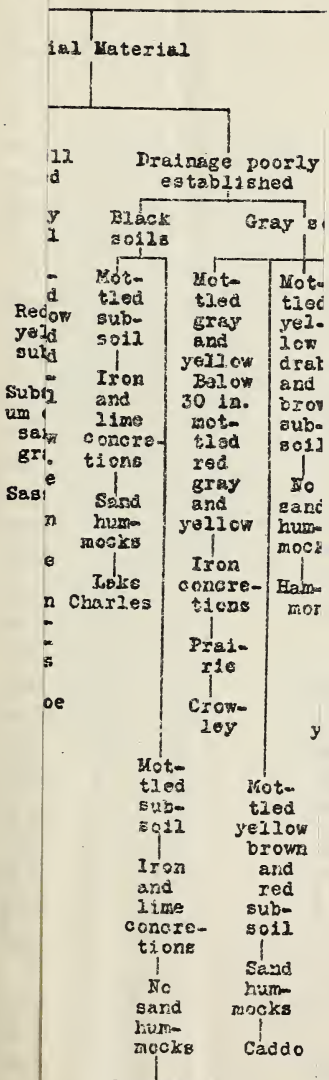
There are 1,346,560 acres, or 4.1 per cent, of loam, the best general purpose soil adapted to vegetables for the late spring markets, the last that can be served in the fresh state from this province, and to a medium type of general farming.

There are 2,203,602 acres, or 6.8 per cent, of silt loam adapted to canning crops and to a heavy type of general farming, with about equal adaptation to wheat and hay.

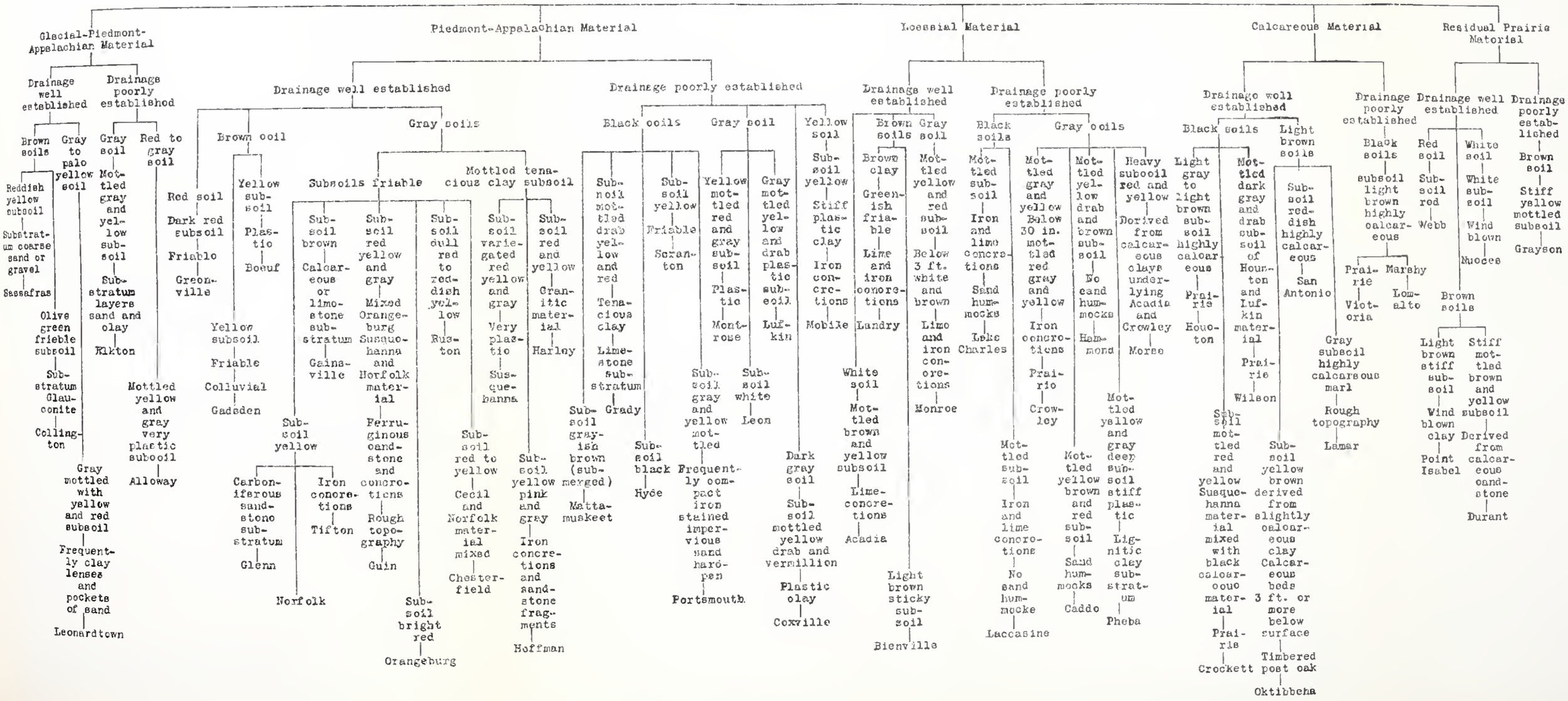
There are 339,168, or 1 per cent, of clay loam (including silty clay loam, and black clay loam), and 4,125,246 acres, or 12.6 per cent, of clay (including black clay, silty clay, and gravelly clay) adapted to very heavy general farming, where hay does better than wheat and ensilage and forage crops become important products.

The last three groups—silt loam, clay loam, and clay—cover an aggregate of 6,497,614 acres, or 20 per cent, of the area surveyed in this province and have not been properly appreciated, as their efficiency can not be fully developed with the usual farm equipment of the region.

The classification of the soils of this province is shown in the diagram, figure 3, facing page 72.


ial Material
Drainage poorly established
Black soils
Gray
Mottled subsoil
Iron and lime concretions
Sand hummocks
Lake Charles
Mottled gray and yellow Below 30 in. mottled red gray and yellow
Iron concretions
Prairie
Crowley
Mottled yellow brown and red subsoil
Sand hummocks
Caddo
Mottled subsoil
Iron and lime concretions
No sand hummocks
Laccasine

Key to the soils of the Atlantic and Gulf Coastal Plains Province.



SOILS OF THE PIEDMONT PLATEAU PROVINCE.

Lying between the Atlantic Coastal Plain and the Appalachian Mountains and extending from the Hudson River to east-central Alabama is an area of gently rolling to hilly country known as the Piedmont Plateau, of which the Bureau has surveyed 10,306,426 acres, in which the soils are derived directly from the disintegration in place of igneous and metamorphic rocks. On the Atlantic side of the plateau it is closely defined by the "fall line" of the rivers where they flow over the eastern edges of the consolidated rocks into the unconsolidated material of the Coastal Plains, as seen, for example, at Baltimore, Washington, Richmond, Columbus, and Augusta, but on the northwestern side the boundary is not sharp, although recognizable. In its northern extension the Piedmont Plateau is quite narrow, but broadens toward the south, attaining its greatest width in North Carolina.

The surface features are those of a broad, rolling plain that has been deeply cut by an intricate system of small streams, whose valley walls are rounded and covered with soil, although many small gorges and rocky areas occur. The altitude varies from about 300 feet to more than 1,000 feet above sea level.

The extreme northern part of the Piedmont region, in New Jersey, has been glaciated, but elsewhere the soils are purely residual in origin and have been derived almost exclusively from the weathering of igneous and metamorphic rocks. The chief exception is the detached areas of sandstone and shales of Triassic age. Marked differences in the character of the rock and the method of formation has given rise to a number of soil types.

The northern portion of the Piedmont, north of an irregular line running in a general diagonal direction across northern Virginia, being narrow, has been subjected to the greatest erosion, as the drainage courses have been steeper. As a result the present level of the land surface is considerably lower than the southern Piedmont. The open season is shorter—about three months—and erosion has so nearly kept pace with rock disintegration that the soil cover is relatively shallow and the rocks as a rule are not far below the surface of the ground. In the southern Piedmont over most of the area the rocks have disintegrated to a depth of 50 feet or more.

To understand the soils and their use for crops it is necessary to consider separately the northern and southern parts of the province, and as the latter is in some respects the simpler it will be considered first.

SOILS OF THE SOUTHERN PIEDMONT.

As the soils of the Piedmont area are derived directly from the disintegration of the old igneous and metamorphic rocks in place

without any chance for mixing or differentiation, save that resulting from superficial erosion products, and as these erosion products have been quickly removed by rapid flowing streams, the texture and character of the soil material is dependent to a very large extent upon rock origin. As a matter of fact the eroded material, so quickly removed from the Piedmont Plateau, has been sorted to a very large extent, so far as coarseness and fineness of the mineral particles is concerned, by the quieter streams of the Coastal Plains or the waters of the bays, estuaries, or the ocean, giving rise to the highly differentiated soils of the Coastal Plains province.

These conditions have resulted in a marked uniformity in the soil material over a large part of the broad expanse of the Southern Piedmont, a uniformity which would have given a nearly uniform crop equivalent were it not for the residual effect of erosion. The dominant soils of the Southern Piedmont, covering six-tenths of the area so far mapped, belong to the Cecil series. . The members of this series consist of the same material physically and chemically, differentiated by the depth of the surface covering, or in the more weathered portion, to variation in depth due to erosion. The Cecil soils are derived from granite and gneiss disintegrated in general to a great depth. The subordinate soils of the Southern Piedmont, subordinate both in extent and in general agricultural value, are derived from different classes of igneous and metamorphic rocks which give more or less markedly different disintegration products, but which do not give rise to anything approaching a complete soil series, nor can such well-defined series as occur in most of the other provinces be expected in the Piedmont Plateau for the reasons already given.

The following diagram shows the relative extent of the different groups of soils in the Southern Piedmont province:

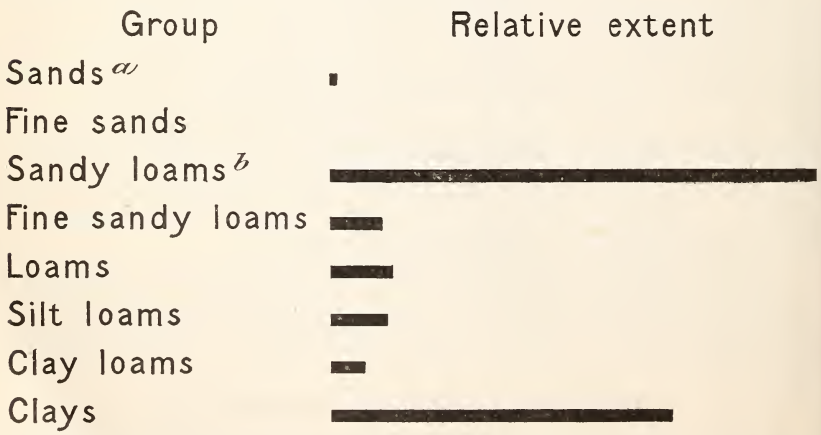


FIG. 4.—Diagram showing relative extent of the important groups of soils in the southern Piedmont Plateau province. [a] Including the coarse sand phase. [b] Including the coarse sandy loam phase.

It is at once apparent that the dominant groups are the sandy loams and clays. By far the largest part of the sandy loams occur in the portion of the area where erosion has been of such a superficial character as to allow the retention of the light sandy loam as a surface covering over the clay to a depth of at least 6 or 8 inches. On such soils a light type of general farming, requiring light farm equipment to maintain the highest efficiency, may be carried on while on the clay soils a much heavier type of general farming should be practiced and a much heavier farm equipment is required.

TABLE XXV.—*Area and distribution of the soils of the Southern Piedmont Plateau.*

DOMINANT (CECIL) SOILS.

Name of soil.	State and area.[1]	Acres.
Deeper soils differentiated by erosion:		
Cecil coarse sandy loam	N. C. 9; S. C. 12	16,256
Cecil sandy loam	Ala. 7, 20, 28; Ga. 2, 3, 6, 8, 9, 10; N. C. 3, 4, 9, 12, 18, 21; S. C. 1, 2, 3, 5, 8, 10, 12, 14; Va. 1, 2, 3, 6, 8, 11.	[2]3,143,960
Cecil fine sandy loam	N. C. 9; S. C. 10	70,016
Cecil loam	N. C. 9; S. C. 12	189,248
Cecil clay loam	Ala. 7, 28; Ga. 8; N. C. 9	[2]249,280
Cecil clay	Ala. 20; Ga. 2, 3, 6, 9, 10; Md. 3, 5, 7; N. C. 1, 3, 4, 9, 12, 18, 21; Pa. 4; S. C. 1, 2, 3, 5, 8, 10, 12, 14; Va. 1, 2, 3, 4, 6, 7, 8, 11.	[2]2,490,627
Shallow soils, due to excessive erosion:		
Cecil gravelly loam	Ga. 8; S. C. 8	[2]27,520
Cecil stony sandy loam	Ala. 7, 28; Ga. 6; S. C. 2	192,192
Cecil stony loam	Ala. 7, 20, 28; N. J. 2; N. C. 9; Pa. 1, 6, 7; S. C. 3, 5	[2]246,697
Cecil stony clay	Ala. 7, 20, 28; S. C. 14	[2]45,504
Total Cecil series		6 671,300

OTHER SOUTHERN PIEDMONT SOILS.

Iredell stony sandy loam	Ala. 28	3,840
Herndon stony loam	N. C. 4	[3]384
Louisa slate loam	Ala. 7, 28	86,656
Durham coarse sand	Ga. 8	[4]3,584
Molena sand	Ga. 9	5,888
Durham coarse sandy loam	Ala. 7, 28; N. C. 4, 9; S. C. 12	[4]58,688
Worsham coarse sandy loam	Ga. 9	15,040
Durham sandy loam	Ga. 10; N. C. 1, 3, 12, 18, 21; S. C. 1, 2, 3, 5, 12, 14; Va. 2, 6, 8, 11.	[4]272,800
Iredell sandy loam	N. C. 4	[5]57,792
Worsham sandy loam	Ala. 28; Va. 11	10,952
York fine sandy loam	S. C. 8, 12, 14; Va. 4	[6]112,576
Iredell fine sandy loam	Va. 4	3,840
Louisa fine sandy loam	S. C. 1, 5; Va. 4, 8	207,040

[1] For key to numbers in this column, see p. 253.
[2] Granites and gneisses, the granites predominating with small scattered areas of diorites and diabases.
[3] Quartzites and quartz schist.
[4] Binary granite (quartz and feldspar).
[5] Diorites and diabases (feldspar and ferruginous minerals).
[6] Phillites, slates, talcose, and mica schists.

TABLE XXV.—*Area and distribution of the soils of the Southern Piedmont Plateau*—Continued.

OTHER SOUTHERN PIEDMONT SOILS—Continued.

Name of soil.	State and area.[1]	Acres.
York loam	Va. 2, 4	4,032
Louisa loam	N. C. 21; Va. 4, 8	[2] 260,074
York silt loam	N. C. 1; S. C. 8, 14	119,284
Edgemont silt loam	Ga. 9	[3] 2,240
Louisa silt loam	S. C. 5	48,384
Iredell clay loam	Ga. 6; N. C. 1, 9, 21; S. C. 1, 5, 14; Va. 2, 4, 7, 8, 11	[4] 245,354
		1,518,448
Total Southern Piedmont surveyed.[5]		8,189,748

[1] For key to numbers in this column, see p. 253.
[2] Phillites, slates, talcose, and mica schists.
[3] Quartzites and quartz schist.
[4] Diorites and diabases (feldspar and ferruginous minerals).
[5] With the exception of some portion of the Rough stony land and Rock outcrop given in a subsequent table as common to both the Southern and Northern portion of the province.

The descriptions and proper use of these soils, considering first the Cecil soils, follow.

DOMINANT SOILS.

DEEPER SOILS DIFFERENTIATED BY EROSION.

Cecil coarse sandy loam.—The soil to a depth of 5 or 6 inches is a brownish-gray to brown coarse sandy loam. A considerable proportion of the sand ranges from very fine to medium in texture, but there is always present sufficient coarse quartz sand and fine quartz gravel or angular fragments of this rock to give a decidedly coarse textured soil. The subsoil is a compact red clay, also containing a considerable amount of coarse sand and fine gravel. Large orbicular masses of granite occur conspicuously in fields, like glacial bowlders. The soil is derived from a coarse-grained gray granite. Cotton and corn are the principal crops grown, the yields averaging about the same as upon the Cecil sandy loam, and being better in wet seasons. Owing to the open structure crops are subject to injury from lack of moisture in dry seasons.

Cecil sandy loam.—The soil is a sandy loam of a brownish or yellowish color about 10 inches deep. The subsoil is a red clay containing considerable coarse sand, both soil and subsoil carrying fragments of quartz. There is usually considerable quartz on the surface. The Cecil sandy loam is the most extensive soil type of the Southern Piedmont Plateau, covering more than one-third of the entire area. This type and the Cecil clay, by reason of their vast extent, completely dominate the agriculture of the region and determine the two main types of farming.

The Cecil sandy loam is the least eroded portion of the Cecil material. It still carries on the surface the more thoroughly disintegrated and weathered remains of the original clay mass, the coarser and more difficult material for the surface waters to remove, and is found therefore on the more gently undulating plateau caps awaiting, unless fully protected, its turn to contribute to the coarser textured soils of the Coastal Plains. As the Cecil sandy loam is, so to speak, an erosion type, advantage may be taken of the difference in depth of the surface covering of sandy loam found in different drainage districts in specialization, especially in the tobacco districts. In the Carolinas and in southern Virginia, where the depth of the surface covering is 8 inches or more, the bright cigarette tobacco is produced. In the same localities where the surface covering is less than this the manufacturing types of tobacco are produced. It is the best soil for the manufacturing tobacco but not for the bright tobacco.

This is the lightest soil of the series desirable for general farming, and it is not well adapted to hay, wheat, or oats, dairying or stock raising. It is worked with the lightest kind of farm equipment, including teams, implements, and buildings. The main crops are cotton and corn, which mature earlier and in general produce lighter yields than should be obtained from the Cecil clay, and the corn is not of such good quality. There is a compensating advantage in that they can be produced with a less expensive farm equipment and with less labor. With cotton, especially, the variety should be carefully selected to maintain the best yields. Cowpeas, crimson clover, and vetch are largely used both for forage crops and for soil improvement, and the growing of these crops should be greatly extended. Of special crops requiring rather intensive and intelligent cultivation, peaches are important, especially in proper exposures in the southern part of the area, while there is considerable opportunity for the production of vegetables to supply the local summer demand of the large and growing cities of the South. Summer apples can be produced to some advantage.

Cecil fine sandy loam.—The soil is a gray or light-brown fine sandy loam to a depth of 5 to 12 inches. The subsoil consists of a stiff red clay. Both soil and subsoil contain considerable chert. The type occupies gently rolling to rolling areas, becoming broken and hilly near the streams. It has good natural drainage. It is derived from the disintegration of fine-grained gneiss and mica schist. The type is well adapted to cotton, melons, and truck crops, although corn, wheat, oats, cowpeas, and clover can be profitably grown.

Cecil loam.—The soil consists of a pale yellow to brownish friable loam, passing at from 5 to 8 inches into a pale-yellow clay loam. This is underlain at 12 inches by a stiff red clay, which sometimes, at about

24 inches, passes into soft, partially decomposed rock. Varying quantities of quartz fragments occur scattered over the surface and to a less extent throughout the soil section. The type occupies level to rolling uplands, and is generally well drained. While it produces poor yields of wheat, oats, corn, and tobacco, the soil is easily tilled and is susceptible of improvement.

Cecil clay loam.—The surface soil is a reddish-brown or light-brown loam to clay loam, ranging from about 6 to 12 inches in depth. The subsoil becomes heavier with depth, passing from a red clay loam into heavy red clay at an average depth of about 30 inches. Fragments of quartz and of the parent rocks, granite and gneiss, sometimes occur scattered over the surface in small quantities. The surface is moderately to rather steeply rolling. The soil absorbs moisture well and the type is not so susceptible to excessive erosion as some of the more rolling and less absorptive members of the Cecil series. It is well adapted to wheat, oats, corn, export tobacco, cotton, and forage crops.

Cecil clay.—This is a clay loam to clay soil of reddish color 3 to 6 inches deep, having a stiff, tenacious clay subsoil of red color. Both soil and subsoil contain quartz and fragments of undecomposed rocks. Occasional rock areas and isolated bowlders or "niggerheads" occur. The type occupies high, rolling land and is recognized as the strongest soil of the Piedmont Plateau for general farming. It is a heavy soil, requiring the heaviest kind of farm equipment in teams, implements, and buildings. Grass for pasture and hay, clover, wheat, and oats enter as important crops, markedly distinguishing the type of farming from that on the Cecil sandy loam. At the same time, to produce these crops successfully more and heavier teams are required. On this type a three-horse plow with heavy horses is needed to do the most efficient work, while a one-horse or two-horse plow with lighter horses will answer on the Cecil sandy loam. Large yields of sorghum and of cowpeas can be obtained. The latter do not produce as much seed, but a much heavier growth of vines than on the sandy loam. It is undoubtedly the best soil for cotton from Virginia south, where early maturing varieties are grown, as the yields are larger, but with the light equipment usually found on the southern farms the sandy loam is at the present time generally preferred. Some damage to cotton on the clay takes place from staining of the lint when it is beaten down by heavy rains. This is the best soil for the Virginia types of export tobacco and an excellent soil for fall and winter apples of the general class represented by the winesap of Virginia.

SHALLOW SOILS DUE TO EXCESSIVE EROSION.

These soils are generally shallow and the topography steep and rolling, unfitting them for general agriculture or for highly special-

ized crops at present in demand. They are for the most part in forest and this use should be encouraged and perpetuated.

Cecil gravelly loam.—The soil is a brown, sandy loam about 7 inches deep, carrying varying quantities of feldspathic or quartz gravel ranging in size from very small particles to fragments one-half inch in diameter. The subsoil is a heavy, micaceous red loam or clay loam containing considerable gravel. Outcrops of granite frequently appear. The type exhibits a lack of tenacity or rather is extremely granular in both soil and subsoil, as a result of which the land erodes and gullies in a serious manner. It usually occupies high, broken uplands, and the drainage is good.

Cecil stony sandy loam.—The soil is a grayish-brown to brown sandy loam carrying rock fragments, usually angular, in sufficient quantity to interfere with cultivation. The subsoil varies from heavy red sandy loam through red sandy clay to a brownish loamy material, consisting of soft partially decomposed rock, clay, and sand. The type sometimes includes nonconformities, too small to separate, in the shape of areas having a yellow subsoil. The soil is derived principally from granite, gneiss, and schist. Though mainly rolling to hilly, considerable areas are steeply broken. Only moderate yields of cotton and corn are secured. The type is better suited to pasturage and forestry than to cultivated crops. Apples do well and peaches frequently give good results. Bermuda grass makes a thrifty growth.

Cecil stony loam.—The soil varies from brown sandy loam to red loam with an average depth of 8 inches, beneath which is a red clay loam or clay. From 30 to 60 per cent of the soil and subsoil is composed of stones and bowlders. The surface is usually hilly and broken.

Cecil stony clay.—The soil consists of a heavy red loam or clay averaging about 8 inches deep, underlain by a stiff red clay. Upon the surface and scattered through the soil and subsoil are 30 to 60 per cent of rock fragments and bowlders. The type occurs on small mountains and hills in the Piedmont Plateau. It is generally too steep and stony for cultivation and best suited to pasturage and forestry.

OTHER SOUTHERN PIEDMONT SOILS.

Iredell stony sandy loam.—The soil is a sand to very light sandy loam with a high percentage of fine gravel and a color varying from brown to greenish-brown. The subsoil is a yellow-brown plastic, very adhesive clay usually having a greenish cast. The type is derived mainly from diorite. It is rather poorly drained and is locally styled "sprouty" or "blue land." Stones are abundant over

the surface. Moderate yields of cotton and corn are secured. Wheat and oats should do fairly well.

Herndon stony loam.—The soil is a grayish to grayish-brown loam, carrying from 20 to 60 per cent of rock fragments. The subsoil is a red clay also containing rock fragments. The topography is very rough and hilly and the soil should be used for forestry or as rough pastures.

Louisa slate loam.—The soil is a light-brown loam to silt loam, carrying considerable fragmentary schist, phyllite, and slabby sandstone. The subsoil is a dull red to red clay loam to clay, also containing rock fragments. The type occupies rolling to ridgy belts. It is derived from metamorphoric rocks, such as schist, phyllite, sandstone, and imperfectly crystalline, rather schistose slate. Occasional areas having a yellowish subsoil have been included on account of their small size. Fair yields of cotton, corn, and oats are made in wet years. Crops suffer considerably in dry seasons. Certain varieties of apples do very well.

Durham coarse sand.—The type consists of a light-gray, incoherent coarse sand, which becomes yellow at a depth of 7 to 9 inches and increases in loaminess with depth until at 20 to 24 inches a yellowish sandy clay is encountered. This lower subsoil is at times mottled or of a reddish color, but yellow predominates. Both soil and subsoil contain varying amounts of quartz and other rock fragments. On account of the coarse texture and open structure the type is decidedly droughty. This is an unimportant soil both in extent and value. Its best use is for special crops, such as sweet potatoes, melons, a number of other early vegetables, and peaches, but the expense of the intensive culture required to produce good yields is so great as to preclude its consideration as a desirable soil even for these crops at the present time.

Molena sand.—The soil is a gray to brown or reddish colored, loamy, medium to rather fine sand which in places is so incoherent that it is blown about by the winds. The subsoil varies from a loamy sand to medium sandy loam in texture, and from yellowish-brown to yellowish-red, or sometimes a dark red in color. A deep red sandy clay is sometimes present below 3 feet. The type occurs as a somewhat broken belt, extending parallel with and some distance back from the Flint River, in the Piedmont Plateau of Georgia. It occupies broad, dome-shaped hills, the crests rising to a height of 200 feet above the stream. The origin of the type is somewhat obscure, but it is probably derived from deeply weathered crystalline rocks. It is an easily cultivated, though droughty soil, from which are secured low yields of a good quality of cotton.

Durham coarse sandy loam.—The soil is a coarse loamy sand or light sandy loam, ranging from about 5 to 12 inches in depth. The

subsoil is a stiff yellow clay containing more or less prominent angular quartz grains and fragments. It is admirably adapted to bright tobacco and fairly well suited to the production of sweet potatoes, watermelons, and a number of vegetables, such as garden peas, cucumbers, etc.

Worsham coarse sandy loam.—The soil, to a depth of 8 to 20 inches, consists of a loamy coarse sand to coarse sandy loam, loose and incoherent in the first few inches, but slightly sticky below. The color of the soil varies from light gray on the surface to yellowish-gray or pale yellow beneath. The subsoil is a pale yellow, heavy, coarse sandy loam passing at about 30 inches into an impervious plastic yellow sandy clay, mottled with red or light drab. The topography varies from gently sloping to flat and undulating. It is a late type owing to its cold nature—the result of imperfect drainage. Little of this soil is under cultivation on account of its low average yields and the difficulty of handling it. Potash is required to prevent cotton rust. Lime should be used liberally and barnyard manure and green crops plowed under in order to build up the productiveness.

Durham sandy loam.—The soil is a coarse to medium loamy sand or light sandy loam, 6 inches deep, underlain with material of the same kind but of lighter color, and this in turn at from 18 to 22 inches by a yellow sandy clay. Usually from 10 to 30 per cent of quartz and other rock fragments are found in both soil and subsoil. The type gives low yields of cotton and corn. It is fairly good for truck, especially sweet potatoes and watermelons, and has been used to a considerable extent for bright tobacco. It is the best soil of the Piedmont for the last-named crop, for while the color of leaf is not quite so bright as in case of the tobacco grown on the Durham coarse sandy loam, the yield is larger.

Iredell sandy loam.—This type is a dark-gray to dull-brown, medium to fine sandy loam overlying, at a depth of from 6 to 10 inches, a yellowish or light-brown, sticky, impervious clay at 24 to 30 inches which grades into soft, disintegrated diorite. The native growth consists of post, red, white, and blackjack oak, cedar, and pine. The type is locally called "black-jack land," or "beeswax land." It is essentially a forest soil, although with suitable drainage fair crops of oats, wheat, hay, and corn can be obtained.

Worsham sandy loam.—The soil is a gray sandy loam, generally of fine texture and of whitish appearance, having an average depth of 12 inches. The subsoil is a yellowish, sticky sandy loam or loam to a stiff plastic yellow clay, mottled with white. The best use of this soil is for forestry.

York fine sandy loam.—The soil consists of a light-gray fine sandy loam, which, at an average depth of about 8 inches, grades into pale yellow, somewhat more compact fine sandy loam. At from 12

to 15 inches it is underlain by compact yellow clay. Quartz fragments are of common occurrence on the surface and throughout the soil mass. The type is derived principally from metamorphic rocks, composed chiefly of talcose and micaceous schists. It occupies gently rolling uplands and has good drainage. Cotton, corn, and forage are the usual crops grown. The yield is somewhat better than on the silt loam but the average is low. For best results organic manures should be supplied in liberal quantities.

Iredell fine sandy loam.—The soil to a depth of about 8 to 10 inches consists of a moderately heavy compact grayish fine sandy loam. The subsoil is an extremely adhesive and plastic, yellowish-brown to dirty-brown clay. Iron concretions are conspicuous in the poorly drained situations. The type is derived from intrusive rock as diorite and chlorite schists. Owing to its intractible structure it is rather difficult to maintain in good condition of tilth. Grass, oats, corn, and cotton are the principal crops grown. Under proper seasonal conditions very fair yields are secured.

Louisa fine sandy loam.—The soil is a light-gray fine sandy loam which usually at a shallow depth grades into pale-yellow fine sandy loam of slightly more compact structure. This is underlain, at from 5 to 15 inches, with a stiff red clay which, at a depth of about 3 feet, sometimes passes into partially decomposed schistose or slaty rocks. Quartz fragments and veins are a common occurrence. The type occupies mainly gently rolling to rolling uplands and has good drainage. It has been formed chiefly through the weathering of talcose and micaceous schist and imperfectly crystalline slates. Cotton, corn, tobacco, and forage are the main crops grown. A fine-textured tobacco is produced on the lighter and deeper phases, while heavier-bodied tobacco is secured from these areas when clay comes closer to the surface. Under ordinary methods the average crop yields are low. For best results organic manures should be liberally used.

York loam.—The soil is a grayish or yellowish compact loam to silty loam with a depth of about 10 inches. The subsoil is a yellow silty clay loam, having a greasy feel. This is underlain, at from 20 to 30 inches, by partially decomposed talcose and mica schist. Both soil and subsoil contain fragments of schist and quartz. The type occupies rolling to hilly topography. The soil is poorly adapted to crops and is best used for fruit.

Louisa loam.—The soil consists of a gray to pale-yellow friable loam which, at a depth of about 5 to 8 inches, grades into a pale-yellow clay loam. This is underlain, at about 12 inches, by a rather stiff red clay which sometimes, at a depth of about 24 inches, has a greasy feel or passes into soft, partially decomposed rock. Varying quantities of quartz fragments are scattered over the surface and

to a lesser extent throughout the soil mass. Schistose fragments are also a common occurrence throughout the soil. The type is derived from talcose and micaceous schist and imperfectly crystalline slates. It occupies undulating to rolling uplands and is generally well drained. The soil is not naturally or easily maintained in good structural condition as it is inclined to run together and bake. Crop yields are low under prevailing methods, but the soil is susceptible of improvement. The crops usually grown are wheat, oats, corn, cotton, and tobacco of heavy body.

York silt loam.—The soil is a light-gray to nearly white compact silt loam which, at a depth of about 8 inches, rests upon yellow, slightly heavier silt loam, which in turn is underlain, at a depth of 10 to 15 inches, by stiff yellow silty clay. Quartz fragments are of frequent occurrence on the surface and throughout the soil mass. The type is derived from imperfectly crystalline metamorphic rocks consisting principally of talcose and micaceous schists. It occupies undulating to gently rolling uplands and is usually well drained. It is locally known as "black-jack" and "white land." It is extremely susceptible to baking and is very difficult to maintain in good structural condition. Cotton and corn are the principal crops, the yields being poor.

Edgemont silt loam.—The soil, to a depth of 6 or 8 inches, consists of a drab or dull-gray to yellowish-gray floury silt loam. The subsoil is a pale-yellow, compact silt loam, becoming heavier with depth. Rock fragments occur on the surface sometimes in sufficient quantities to interfere with cultivation and generally in varying proportions throughout both soil and subsoil. The type occupies the crests and upper slopes of high monadnock hills and peaks. The surface configuration promotes ready surface drainage, though the soil itself becomes more or less soggy during wet seasons, owing to the impervious nature of the subsoil. This is a cold soil, and at the same time one subject to excessive surface loss of moisture during dry weather. Very little is under cultivation. It is essentially a forest soil and should be devoted to forestry.

Louisa silt loam.—The soil is a yellowish-gray to nearly white compact silt loam, having an average depth of about 8 inches. This grades through compact red silt loam into the subsoil proper at a depth of about 14 inches, which is a stiff red silty clay. Quartz fragments are of common occurrence on the surface and throughout the soil. The type is derived from fine-grain imperfectly crystalline metamorphic rocks, consisting chiefly of talcose and micaceous schist. It occupies level to rolling uplands and usually has good drainage. The soil is extremely inclined to compact and bake and is a difficult soil to maintain in good structural condition. It is used principally for cotton, corn, and grain, the yields being poor.

Iredell clay loam.—The soil is a dark-brown loam, 8 inches deep, containing small rounded iron concretions. The subsoil is a stiff, impervious yellow clay, underlain by a soft decomposed rock. The type occupies level or slightly rolling areas. It is locally known as "black-jack" or "beeswax land," the latter term being suggested by the character of the subsoil. Level areas are inclined to be swampy on account of the impervious nature of the clay subsoil. This is essentially a forest and grass soil, although with proper drainage fair crops of cotton, corn, and wheat are obtained.

SOILS OF THE NORTHERN PIEDMONT PLATEAU.

The northern extension of the Piedmont Plateau is comparatively narrow, and the soils are dominated by the Chester series (derived from gneiss, granite, and schist) and the Penn series (derived from the dark Indian-red sandstone and shale of Triassic age, which for convenience and because of their geographic position have been classed as of this province). The remaining soils are subordinate in extent and in agricultural value.

The relative extent of the different groups of soil are shown in the accompanying diagram.

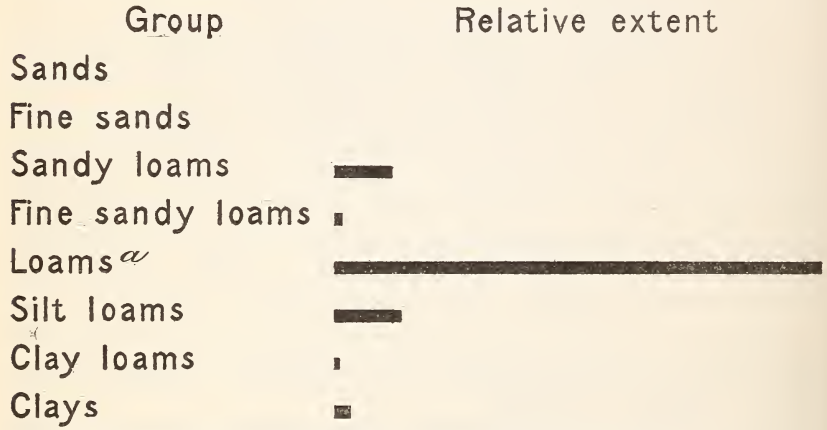


FIG. 5.—Diagram showing relative extent of the important groups of soils in the northern Piedmont Plateau. [a] Including the shale loam phase.

The soils so far encountered with the areas mapped and in general terms the classes of rocks from which they are derived are given in the following table:

TABLE XXVI.—*Area and distribution of the soils of the Northern Piedmont Plateau.*

DOMINANT TYPES.

Name of soil.	State and area.[1]	Acres.
Penn sandy loam	N. J. 2; Pa. 1, 7; Va. 1, 4	[2]61,774
Bradley sandy loam	Va. 5	59,072
Chester sandy loam	Md. 7; Va. 7	[3]27,968
Berks sandy loam	Pa. 2	10,560
Chester fine sandy loam	Pa. 4, 9	[3]6,080
Chester loam	Md. 3, 5, 7; Pa. 1, 2, 4, 9; Va. 1, 7; W. Va. 1	[3]600,680
Penn loam	Md. 7; N. J. 2; Pa. 1, 2, 4, 7; Va. 4, 7	[4]320,266
Manor loam	Md. 3, 5, 7, 8; Pa. 4, 6, 9; Va. 7	[5]166,514
Penn shale loam	Pa. 1, 2	[6]118,784
Berks shale loam	Pa. 2	172,800
Lansdale silt loam	Pa. 2, 4, 9; Va. 7	[7]108,288
Penn silt loam	Pa. 9	[6]61,824
Berks silt loam	Pa. 2	17,600
Penn clay loam	Pa. 2	896
Conowingo clay	Md. 3, 5; N. C. 12; Pa. 4; Va. 1	[8]49,894
Penn clay	Md. 7; Va. 1, 7	[6]27,904
Total		1,810,904

OTHER NORTHERN PIEDMONT SOILS.

Penn gravelly loam	Md. 7; Va. 7	[9]704
Cardiff slate loam	Md. 5; Pa. 1	[10]2,458
Penn stony loam	N. J. 2; Pa. 2, 4, 7, 8; Va. 7	[2]77,704
Manor stony loam	Pa. 4, 6, 9	38,956
Chester stony loam	Pa. 2, 4	84,864
Lansdale stony loam	Pa. 2	3,648
Penn gravelly sandy loam	Pa. 2	17,344
Total		1,225,678
Total Northern Piedmont surveyed[9]		2,036,582

[1] For key to numbers in this column, see p. 253.
[2] Red sandstone.
[3] Gneiss, granite and schist (gneiss predominating).
[4] Red sandy shale.
[5] Mica schist.
[6] Red shale.
[7] Gray shale.
[8] Serpentine, steatite, and similar magnesian rocks.
[9] Conglomerate.
[10] Gray to black slate.
[11] With the exception of some areas of Rock outcrop, barrens, and Rough stony land given in a subsequent table as common to both the northern and southern portions of the area.

THE SANDY LOAM GROUP.

This group of soils comprises by far the best truck, vegetable, and small-fruit soils of the Northern Piedmont, and the lightest desirable soils for general farm crops.

Penn sandy loam.—The soil is a sandy loam from 6 to 15 inches deep, underlain by Indian-red or brown loam or clay loam. Sandstone fragments, to the extent of 5 to 20 per cent of the soil mass, are

generally present. The surface varies from rolling to moderately hilly. The soil is easily tilled and produces crops of good quality but comparatively light yield. It is particularly adapted to vegetables, small fruits, and summer apples.

Bradley sandy loam.—The soil consists of a dark-gray sandy loam, underlain to a depth of 6 to 14 inches by a light-gray or yellowish material of approximately the same texture. The texture of the sandy material varies from fine to medium, with now and then some coarse sand and both angular and rounded quartz gravel. The subsoil from 14 to 36 inches is a stiff red to yellowish-red clay, frequently containing mica particles and some sand, and increasing in tenacity with depth. This type varies in topography from rolling to undulating and occurs in irregular and broken areas, usually as narrow strips bordering stream courses or on narrow ridges or knolls between streams. It is residual in origin, but is modified to some extent by an admixture of sedimentary material. The type is devoted to general farming, the principal crops being corn, oats, and some wheat. Small yields are obtained. The soil is by nature better adapted to vegetables.

Chester sandy loam.—The soil is a heavy brown or gray sandy loam, about 8 inches deep, underlain by a heavy yellow loam or clay loam. The subsoil in places runs high in medium and coarse sand. The surface material is not a loose sandy loam, but has the properties of a loam, containing, however, considerable quantities of coarse quartz fragments. The type occurs in rolling and somewhat hilly areas, generally well drained, and is derived from the weathering of granite, gneiss, and coarse-textured schist, the original rocks containing a large amount of feldspar. This is a good soil for corn, yielding from 40 to 50 bushels per acre. It is too little retentive of moisture for wheat, which produces only from 10 to 15 bushels, but is a fairly good soil for grass and clover. Only moderate yields of wheat are secured.

Berks sandy loam.—The soil is a medium to fine light-brown sandy loam, from 6 to 8 inches deep. The subsoil is a yellowish-brown rather heavy medium to fine sandy loam, often containing sufficient silt and clay to make it compact. In many places sandstone and shale fragments are present in both soil and subsoil. It is derived from fine-grained flaggy sandstone interbedded with the shale. Rolling to hilly topography is the characteristic topography, and the drainage is good. The soil has a tendency to droughtiness and is more difficult to cultivate and less productive than the Berks shale loam or Berks silt loam. Corn, oats, wheat, rye, grass, and a few potatoes are grown, but the soil is not especially adapted to any of these crops and the yields are not very satisfactory. It can be used with fair success for pasture.

THE FINE SANDY LOAM GROUP.

Chester fine sandy loam.—The soil consists of a brown or yellow fine sandy loam, 10 inches deep, generally quite sandy in the lower slopes. The subsoil is a yellow fine sandy loam to fine sand. It often contains considerable rock fragments and occasionally is distinctly micaceous. The type occupies moderately to steeply rolling country and generally has good surface and subsurface drainage. Where the topography is suitable, this soil is adapted to the production of early vegetables and potatoes.

THE LOAM GROUP.

This group contains the two great corn soils of the Northern Piedmont, and constitutes what may be classed as a medium grade general farm soil, in that it contains the best soils for corn and oats and second best for wheat and hay. It comprises good soils for grazing and summer fattening of cattle and for a type of dairying where pasture is largely used for summer and fall feeding.

Chester loam.—The soil consists of a brown or yellowish loam, sometimes slightly sandy, containing some mica. This is underlain by a heavy yellow loam subsoil, grading into clay loam, which in lower depths becomes somewhat lighter in texture and more micaceous. The color is sometimes reddish yellow or red. Fragments of quartz and other rocks are usually found on the surface and throughout the soil section. The surface is rolling to hilly and the drainage is good. The soil is a good type for use in general farming, but requires careful treatment on slopes, where it washes badly. It is excellent for corn and oats and nearly as good for wheat and hay. Cigar tobacco is produced to some extent on this soil in Pennsylvania and certain apples of the fall and early winter varieties do well.

Penn loam.—The soil is a dark Indian-red loam from 8 to 12 inches deep, underlain by an Indian-red clay loam. Both soil and subsoil occasionally contain from 5 to 20 per cent of sandstone fragments. The surface is gently rolling. The drainage is fair, but plowing in beds is generally practiced to assist the natural drainage, and over much of the area tile drainage should be installed for the best results. It is a first-class soil for corn and oats and nearly as good for wheat and grass.

Manor loam.—The soil consists of a yellow or yellowish-brown heavy loam, 8 inches deep. The subsoil consists of a yellow or reddish-yellow heavy loam, which grades into a clay loam at a lower depth. Mica schist fragments sometimes occur throughout the soil profile, while occasionally the lower portion of the subsoil consists largely of small mica particles, which render it feathery and fluffy. The topography ranges from gently to moderately rolling, with occa-

sional hilly areas. The type is well drained, but washes badly in the steeply rolling areas. It produces fair yields of general farm crops, but not so good as the two preceding types.

SHALE LOAM PHASE.

Penn shale loam.—The soil is a dark indian-red loam, about 8 inches deep. The subsoil consists of a heavy indian-red clay loam grading into clay, and is of variable depth, always resting upon the shale rock from which it is derived. From 10 to 40 per cent of shale fragments occur in the surface soil, giving it the local name of "red-gravel land," and the quantity always increases in the subsoil. The drainage conditions of the type depend upon its topography, because the underlying beds of shale prevent the downward percolation of water to any great depth. It usually occurs as broad, rolling valley land, with surface features sometimes sharply broken. The soil is fairly well adapted to wheat, oats, corn, and hay. It is essentially a forest soil.

Berks shale loam.—The soil is a heavy loam or silt loam, from 6 to 10 inches deep, ranging in color from brown to yellowish brown, with occasional spots of red. It contains from 40 to 70 per cent of shale fragments. The subsoil is usually a heavy silty loam, or silty clay loam, generally lighter in color than the surface soil and containing a large quantity of shale fragments. This is underlain by unbroken shale at depths ranging from 18 inches to 5 feet. The topography ranges from "billowy" to moderately rolling, with tops of hills and ridges well-rounded and usually from 50 to 100 feet higher than the adjacent limestone valleys. Liability to erosion necessitates careful preventative measures. The soil is well adapted to general farming, except for its tendency to drought where the soil is shallow. Potatoes do especially well and the type includes many areas well adapted to the production of apples, peaches, and small fruits. Corn yields 20 to 60 bushels; wheat 15 to 30 bushels, oats 25 to 50 bushels, potatoes 125 to 250 bushels, and hay $1\frac{1}{4}$ tons per acre.

THE SILT LOAM GROUP.

The silt loams approach the type of soils which may be designated as heavy farming soils. More labor must be expended in keeping them in good condition than in case of the sandy loams or loams, and heavier teams must be used, and wheat and hay come in as crops of nearly first rank, although corn is still a very important field crop, and pasture is indicated rather than grass for hay.

Lansdale silt loam.—The soil consists of a brown or slate-colored medium to heavy silt loam from 10 to 14 inches deep. The subsoil, to a depth of 36 inches or more, consists of a silty clay loam or heavy

silty loam, grading into silty clay loam at an average depth of 20 inches. The subsoil ranges from pale yellow to yellowish gray in color and is generally lighter than the surface soil. The surface features range from gently to moderately rolling and the drainage is adequate. The soil is adapted to the production of general farm crops, as stated above, with potatoes for the fall and winter markets an important product.

Penn silt loam.—The soil consists of a reddish or reddish-brown silt loam from 8 to 12 inches deep. The subsoil is an Indian-red or light-brown silt loam somewhat heavier than the soil and grading usually into a red silty clay loam in its lower depths. Soil and subsoil contain from 5 to 15 per cent of shale and sandstone fragments. The surface ranges from slightly to steeply rolling. The drainage on most of the areas is very good, but on slopes where the bed rock lies near the surface seepy spots are often encountered. The soil is well adapted to the general farm crops, especially wheat, hay, oats, and corn in about the order named.

Berks silt loam.—The type consists of 10 inches of brown or yellowish-brown silt loam or heavy silty loam underlain by heavy yellow silt loam, which grades into silty clay loam at 16 to 20 inches, this resting upon undecomposed shale at depths ranging from 30 inches to 4 feet. A few shale fragments are found on the surface and the subsoil may contain 10 to 25 per cent of such coarse material. The type is derived from the Hudson River shales and has a level to gently rolling surface. It is a strong soil for general farming. Average yields are: Corn, 45 bushels; oats, 40 bushels; wheat, 22 bushels; and hay, 1½ tons an acre.

THE CLAY LOAM GROUP.

Only one soil in the clay loam class has so far been mapped in the northern section of the Piedmont Plateau province. It is an important soil in the Penn series.

Penn clay loam.—The surface soil, to an average depth of 8 inches, consists of a brownish-red material, varying from a heavy loam or silt loam to a clay loam or even clay in texture. Typically it is a distinct clay loam. The subsoil to a depth of about 36 inches is a dark-red clay, very plastic, and possessing a distinctly greasy feel. This type has been formed by the decomposition of Triassic shale, fragments of which are occasionally found on the surface. Its topography is rolling to hilly. Its crop adaptation is similar to that of the Penn loam and the yields secured are about the same on both types. It is somewhat harder to handle than the Penn loam, because of heavier texture and closer structure, but it is more resistant to drought than the Penn loam, and consequently produces better crops in dry seasons.

THE CLAY GROUP.

The clays are the heaviest soils of the series and the hardest to work and keep in order, but when properly handled they give the best yields, especially of wheat and hay, although fine yields of corn and oats are obtained. Clover does well, and forage crops, for ensilage, and roots give very large yields, so that the most intensive form of dairying, where pasturing is not necessary, but the cows are fed throughout the year for large milk and butter production, can be practiced.

Conowingo clay.—The soil is a yellow to brown or reddish-brown loam about 8 inches deep, underlain by a yellowish-red to red clay or clay loam. In the subsoil decomposed fragments of steatite give a greasy feel. Occasionally rock fragments occur on the surface, but not to exceed 25 per cent. This type occupies rolling land and the drainage is usually adequate. It is productive for general agriculture, comparing favorably with the Cecil clay and Cecil loam of the Southern Piedmont, though not so productive as the Penn clay. It is known in Maryland as productive "serpentine land," in distinction from the Conowingo barrens derived from the same rocks, less weathered, and found in contiguous areas which are extremely unproductive.

Penn clay.—The soil is a dark Indian-red to dark reddish-brown clay about 8 inches deep. The subsoil is a dark Indian-red clay grading into stiffer clay. The type occurs in gently rolling upland, as a series of low ridges. The drainage is good. This soil requires heavy teams, but when thoroughly prepared it is the best hay soil in the province. It is also fine for wheat, but rather heavy for corn.

OTHER NORTHERN PIEDMONT SOILS.

The soils of these phases of the above groups are essentially forest soils, although in favored localities general farm crops and some fruits are grown to a limited extent.

GRAVELLY LOAM.

Penn gravelly loam.—The soil is a dark Indian-red or brown sandy loam about 8 inches deep, containing from 10 to 60 per cent of small rounded sandstone gravel. The subsoil is a dark Indian-red loam or clay loam. The type occurs as high rolling upland. The drainage is good, but the soil is inclined to wash badly. It produces fair yields of corn, wheat, vegetables, and small fruits.

SLATE LOAM.

Cardiff slate loam.—The soil is a heavy yellowish-brown loam, with a depth of about 8 inches, underlain by heavy yellow silty clay to a

depth of 3 feet or more. Both soil and subsoil contain from 15 to 40 per cent of partially decomposed slate fragments. The type occurs on prominent narrow ridges and is derived from the decomposition of fine-grained slate. The presence of the slate fragments make quite friable what would otherwise be a refractory clay. Much of the type is forested with oak, chestnut, and other trees. It is essentially a forest soil, and should be kept as such, although in its blacker phase it produces fair crops of corn, wheat, rye, oats, and grass.

STONY LOAMS.

Penn stony loam.—This type consists of very stony land, hilly to mountainous in character, generally covered with a natural forest of chestnut and oak. The soil consists of a rather heavy Indian-red loam, 8 to 10 inches deep, containing from 30 to 60 per cent of red or brown sandstone fragments. The subsoil is much the same in character to a great depth. This type is derived from the more siliceous or harder parts of the Triassic sandstone. It is well adapted to forestry and is essentially a forest soil. Fruit, especially apples for the fall and winter market, does well, but it is impossible to give the trees the careful attention in the way of soil treatment and spraying that is required in the first-class orcharding of the present time. On the more level areas where the stones are removed general farm crops do fairly well.

Manor stony loam. The soil to a depth of 8 to 10 inches consists of a clay loam or heavy loam, containing large quantities of small rock fragments. The subsoil is a light-yellow or slightly grayish loam to clay loam. The subsoil always contains a high percentage of small schist fragments, and sometimes is a mass of these, with only the interstitial spaces filled with soil. The surface is hilly to mountainous. Where cultivation is possible the soil produces fair yields of the staple crops. The type is largely forested and should be allowed to remain so.

Chester stony loam.—The surface soil has an average depth of 10 inches and consists of a medium to heavy brown loam. The subsoil is a yellow or yellowish-red clay loam that usually grades into a stiff clay at depths ranging from 24 to 36 inches. Stones and bowlders are scattered over the surface and mixed with both soil and subsoil in quantities varying from 30 to 60 per cent of the mass. This type occurs in small irregular areas scattered throughout the Chester loam. The topography varies from moderately rolling to hilly, and the type forms steep slopes and the summits of hills and ridges. Much of it is used as permanent pasture, though where the slopes are not too steep good crops are secured.

Lansdale stony loam.—The soil consists of drab, slate-colored, or gray silty loam or silt loam, with an average depth of 8 inches. The surface is usually strewn with fragments of metamorphosed Triassic

sandstone from which the type is derived. The subsoil consists of a slate-colored or gray heavy silty loam grading into a silty clay loam. Stones are abundant and bed rock may be encountered at a depth of 2 to 4 feet below the surface. The surface is rolling to hilly and the drainage is thorough. Crops suffer from drought on much of the type. Corn, wheat, oats, rye, and grass are grown, but the yields are considerably lower than on the Lansdale silt loam.

GRAVELLY SANDY LOAM.

Penn gravelly sandy loam.—The soil is a red-brown to Indian-red gravelly sandy loam, about 10 inches deep. The subsoil is always heavier than the soil, a heavy sandy loam, loam or even clay loam to 24 inches, below which it is frequently a sandy clay. Soil and subsoil contain from 20 to 60 per cent of small and large quartz gravel, which on the surface often gives a gray appearance to the fields. Varying quantities of red sandstone gravel also are found. The surface is rolling to hilly, and the areas are well drained and mostly under cultivation. The type is derived from conglomerates of Triassic age. It is used principally for general farming, but is not especially desirable for this purpose on account of droughtiness.

NONPRODUCTIVE MATERIALS.

The following nonproductive materials are found in both the Northern and Southern Piedmont:

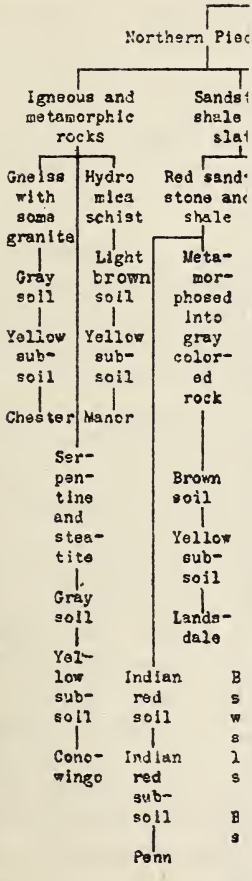
TABLE XXVII.—*Area and distribution of the nonproductive material.*

Kind of material.	State and area.[1]	Acres.
Rough broken land	N. C. 4	38,912
Rough stony land	Ala. 20; Ga. 9; Pa. 4, 9	25,152
Conowingo barrens	Md. 3, 5; Pa. 4; Va. 1	15,200
Rock outcrop	N. C. 9; S. C. 14	832
Total		80,096

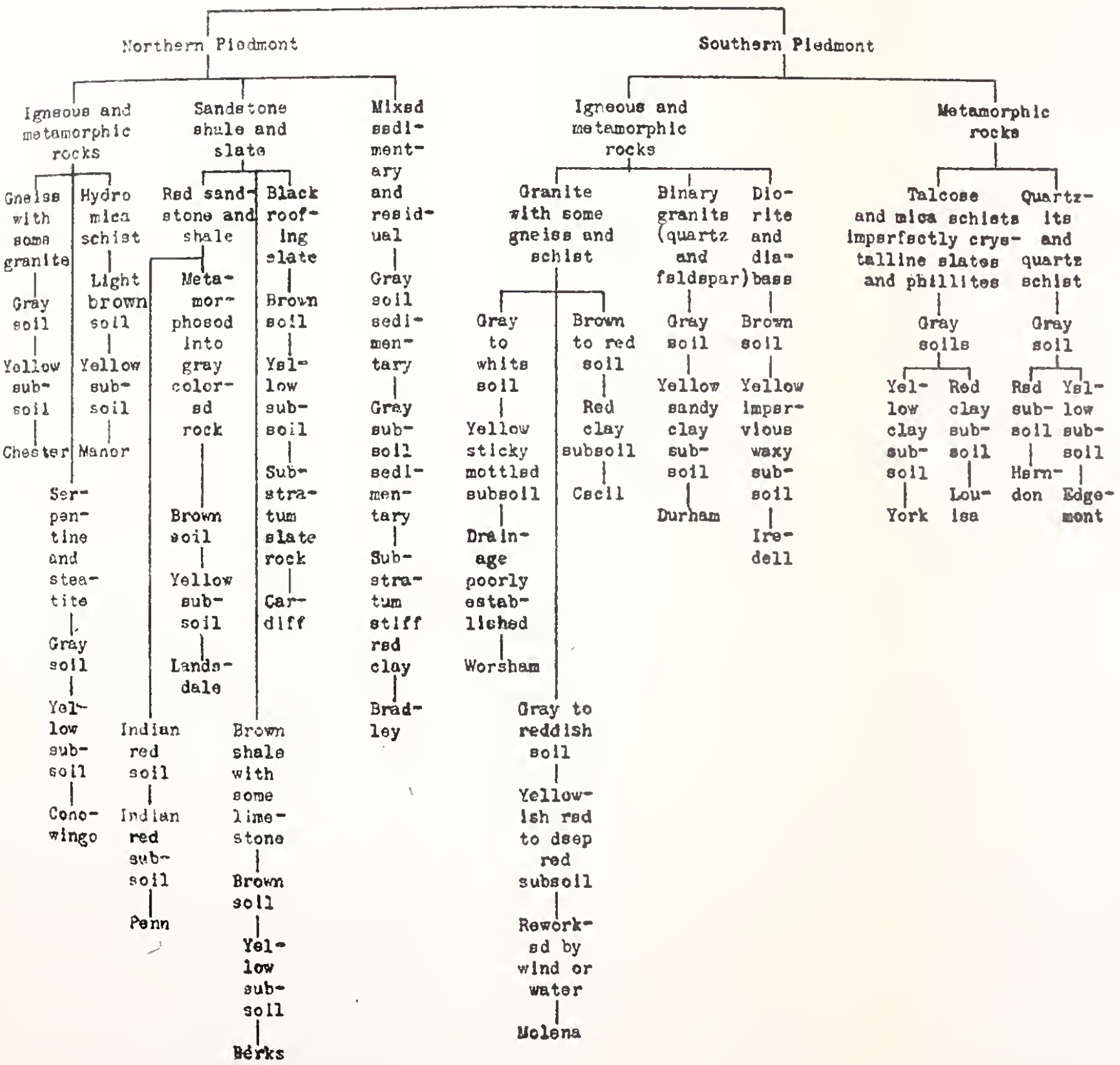
[1] For key to numbers in this column, see p. 253.

Rough broken land.—In topography Rough broken land is rolling, hilly, and rough, lying between stream-bottom land and the less broken uplands. Erosion has kept such close pace with rock degradation that the accumulation of soil has not been deep. The best use of this soil is for forestry purposes, as it is poorly adapted to agricultural uses.

Rough stony land.—Under this heading have been classed areas so stony and broken as to be nonarable, although permitting timber growth and use for pasturage to some extent. These areas frequently consist of steep mountain ridges, bluffs, or narrow strips extending through definite soil types, and differ from Rock outcrop


Northern Piec
Igneous and metamorphic rocks
Sands shale sla
Gneiss with some granite
Hydro mica schist
Red sand stone an shale
Gray soil
Light brown soil
Meta- mor- phosed into gray color- ed rock
Yellow sub- soil
Yellow sub- soil
Brown soil
Chester
Manor
Yellow sub- soil
Ser- pen- tine and stea- tite
Gray soil
Yel- low sub- soil
Lands- dale
Indian red soil
Cone- wingo
Indian red sub- soil
Penn

Key to the soils of the Piedmont Plateau Provinces.



in that they support vegetation of economic value and from the stony loams in being nonarable.

Conowingo barrens.—The soil covering is usually very shallow, seldom exceeding 3 feet, and in many places the surface material consists of broken rock, with little or no interstitial material. The soil varies in texture from a course sandy loam to a loam or silty loam, the heavier classes predominating. The material occupies rolling to hilly and broken uplands and is derived from the decomposition of serpentine and similar magnesian rocks. It is generally unproductive and worthless for agricultural purposes, partly owing to the shallow depth of soil and partly to its stony, leachy character. The soil supports a stunted growth of trees.

Rock outcrop.—This term is used to designate areas consisting of rock ridges, exposed rock outcrops, or accumulations of stone entirely unfit for cultivation and incapable of becoming agricultural land.

SUMMARY.

A careful study of the soils of the Piedmont Plateau province fails to reveal the opportunities for the highly specialized industries possible in some of the other soil provinces, but points to more highly developed general farming than is now practiced.

The dominant soils of the Southern Piedmont are the sandy loams, which are adapted as a class to vegetables that mature rather late for the northern markets and that are not of the quality desirable for storage or canning purposes, to fruits, and to a light type of general farming, of which early crops and rather light yields of cotton and corn form the basis.

The clays forming the other large and important group are heavy soils to handle, and require a heavy farm equipment. If properly handled, they should constitute the best soils of the section. The largest yields and better quality of corn and cotton should be produced upon them, and wheat, hay, and dairy farming should be important industries.

The subordinate soils are subordinate both with respect to acreage and to agricultural value.

In the Northern Piedmont the dominant soils are the loams, with a very much smaller extent of silt loams and clays, all of which require heavy or very heavy farm equipment to promote their highest efficiency, to produce the large yields of wheat, corn, and hay which can be secured, and to carry on the dairy farming, which is one of the important industries of the locality. The relatively small extent of sandy loam gives the only opportunity for light general farming, as no sand or fine sand and practically no fine sandy loam has been encountered in the area.

The classification of the soils of this province is shown in the diagram, figure 6, facing page 92.

SOILS OF THE GLACIAL AND LOESSIAL PROVINCE.

The Glacial and Loessial province contains the great wheat and corn soils of the country, and, together with the Glacial Lake and River Terrace province, furnishes a large part of the summer and winter vegetables and fruit. The Atlantic and Gulf Coastal Plains supply fresh vegetables and fruit from January to June, while the supply for July to October and the winter supply come mainly from the two glacial provinces, the lighter soils maturing the crops for the summer supply and the heavier soils for the winter supply of stored and canned vegetables. The order in which these supplies come in is indicated in the description of the several groups of soils. In the Coastal Plain province, where light soils predominate and the farm equipment adapted to them is light, the heavier soils have not

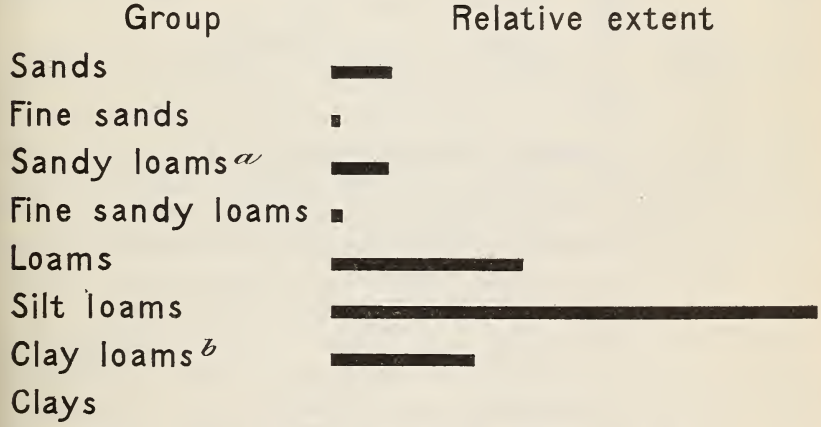
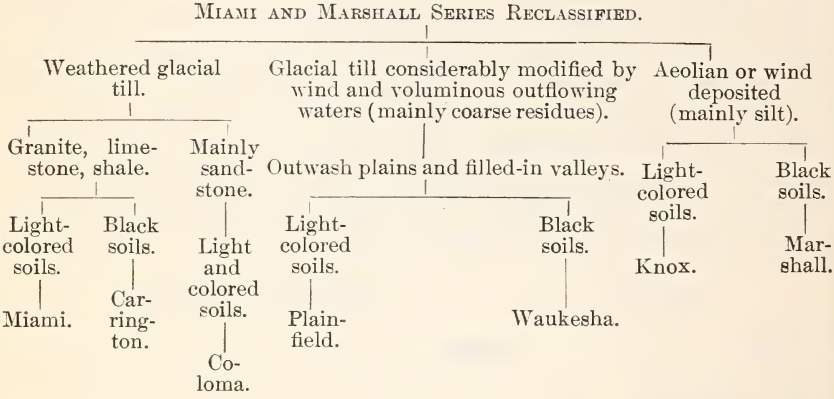


FIG. 7.—Diagram showing the relative extent of the important groups of soils in the Glacial and Loessial province. [a] Including coarse sandy loam phase. [b] Including black clay loam phase.

been fully appreciated nor their highest efficiency developed. On the other hand, in the glacial provinces the heavy soils predominate and the farm equipment is correspondingly heavy and the light soils have not been fully appreciated.

The relative extent of the different grades of soils in this province is shown diagrammatically in figure 7, from which it will be seen that the dominant soils are silt loams, with loams and clay loams each covering about one-third as large an area.

The soils of this province are the products of glaciation and subsequent wind action. When glaciation has been deep, as in the Central and North Central States, the material presents itself in three phases which show decided differences in the soil material. The soil surveys have progressed so far that with the material in hand it has been possible by breaking up and reclassifying the old Miami and Marshall series to straighten out the difficulties which have heretofore been encountered in the classification of the soils of this province and to make clearer and simpler what has seemed to be a very complicated problem. The scheme of reclassification is as follows:



The Knox and Marshall series as reconstructed occupy mainly the southern half of the province, with an extension southward in the Mississippi Valley. The Miami and Carrington border this belt upon the north, while the Coloma, Plainfield, and Waukesha series occur mainly in the northern part of the province, being typically developed in northern Michigan, Wisconsin, and Minnesota.

More specifically, it may be said that a typical product of ice grinding is the bowlder clay, a heterogeneous mass of rocks and pebbles which have partially ground themselves up in the ice movement and which have been left embedded in a silty matrix. The weathering of this material has given rise typically to the Miami clay loam. Another direct product of the ice movement, where the material has possibly contained less of the softer rocks, such as the limestones, and is derived principally from the harder igneous or sandstone rocks, and where the remaining bowlders are less rounded and generally larger, gives rise to the Miami loam.

Over the bowlder clay in a large part of the Prairie States has been deposited a remarkably uniform layer of material, from 3 feet to many feet in depth, which analyzes a silt loam and which, except in eroded districts, is usually free from rocks and stones. This silty

covering is a wind deposit or has possibly been deposited by glacial flood waters. Such material gives us typically the Knox silt loam, or the Marshall silt loam, according to the drainage conditions which have prevailed subsequently to deposition.

In the northern extension of the Glacial and Loessial province, typically in central and northern Michigan, Wisconsin, and Minnesota, are large bodies of sandy soils, derived probably through the ice grinding of hard sandstones and igneous rocks, which show in places evidence of both wind and water action. The materials in this case are the residue of an original heavier deposit, the finer material having been carried away and deposited in other localities. This condition is particularly marked in the case of the outwash sand plains, where the rushing glacial waters carried off the finer material over wide areas, leaving the coarser material as the present cover. Such material gives us typically the Coloma, Plainfield, and Waukesha sands and sandy loams.

In New York and the New England States the glacial action has been more superficial. Here the material is derived largely from the local rocks, and we find, as would be expected, a larger number of soil types.

THE SAND GROUP.

These soils produce the early summer crops of vegetables and fruits and should be used for this purpose so far as transportation facilities permit and the market demands justify. Like the sands of the Coastal Plains, these soils produce very early crops for the several localities in which they occur, but the yields are light, and the quality, flavor, and keeping qualities are not so good as on the heavier soils, which with slower growth mature crops later.

TABLE XXVIII.—*Area and distribution of the sands.*

Name of soil.	State and area.[1]	Acres.
Coloma sand	Ind. 6; Mich. 1, 2, 3, 4, 5, 7, 8, 10; Minn. 2; Ohio 10; Wis. 2, 3, 5, 6, 7.	1,226,824
Plainfield sand	Wis. 3, 7	89,088
Knox sand	Ind. 3, 8; Nebr. 1	37,632
Waukesha sand	Ind. 6, 7; Iowa 1; Wis. 7	36,992

[1] For key to numbers in this column, see p. 253.

Coloma sand.—The soil to a depth of about 8 to 16 inches consists of a light-brown to brown slightly loamy sand. The subsoil is a yellow slightly loamy medium sand, which frequently becomes coarser in the lower portions. Fine gravel is often encountered in the subsoil, and gravel beds may be encountered below 30 to 36 inches. The type occupies gently to steeply rolling country and includes a con-

siderable number of low and rounded ridges and hills and occasional intervening plains. It represents residuary material resulting from reworking of glacial till by wind and water. Owing to its open structure, the type is not very retentive of moisture, and crops are liable to suffer in dry seasons. When liberally supplied with organic manures, wheat, corn, and oats give moderately good yields. Potatoes, small fruits, and grapes do moderately well. The type is probably best suited to the production of vegetables.

Plainfield sand.—To an average depth of about 10 inches the soil consists of a brown to yellow slightly loamy sand. The subsoil is a heavy loose yellowish-brown medium sand, which becomes lighter in color and coarser in texture as depth increases. A small amount of fine gravel is commonly encountered at a depth of about 2 feet. Practically no stones are to be found on the surface of this soil. The type occupies broad, level, filled-in valleys and out-wash plains of glacial material which has been left by the action of strong glacial waters. Owing to the loose porous nature of both soil and subsoil the type is excessively drained and light yields are secured except in wet seasons. Potatoes give best results. Corn, rye, oats, and hay are the other crops commonly grown.

Knox sand.—The soil consists of yellowish-brown or brown medium sand, with an average depth of about 10 inches. The subsoil is a yellowish brown medium sand, sometimes carrying a small amount of fine gravel. The surface configuration varies from gently rolling to that characterized by low, moundlike hills. Corn, wheat, oats, and sugar beets are grown, but give only moderate yields. Melons, sweet potatoes, and other garden truck do particularly well. Alfalfa has been successfully grown, although it is rather difficult to get a good stand. The soil material is mainly the result of wind deposition.

Waukesha sand.—The soil to a depth of about 10 to 15 inches is a dark-brown to black sand. The color becomes lighter as depth increases. The subsoil proper is a yellow sand of practically the same texture as the surface soil. Frequently the lower portion of the subsoil contains varying quantities of fine gravel. The type is usually level to undulating in topography, and is well drained, crops sometimes suffering for lack of moisture. It represents material resulting from the reworking of glacial till by wind and rushing glacial waters. Corn, oats, rye, and timothy are the principal crops grown. The yields are generally small and uncertain, being larger in wet seasons. Vegetables and melons do well.

THE FINE SAND GROUP.

This small group represents trucking soils of somewhat greater productivity though somewhat later in maturing the crops than the coarser sands of the last group.

TABLE XXIX.—*Area and distribution of the fine sand group.*

Name of soil.	State and area.[1]	Acres.
Knox fine sand	Ill. 8, 10; Ind. 10; Iowa 4; Nebr. 6	87,360
Marshall fine sand	Iowa 3; Minn. 1; Nebr. 2; N. Dak. 2	44,480
Coloma fine sand	Ill. 11; Mich. 1, 3, 6; Minn. 2	36,300

[1] For key to numbers in this column, see p. 253.

Knox fine sand.—The soil consists of a light-brown to pale-yellow loamy fine sand, having a depth of something like 10 to 14 inches. The subsoil is a yellow or pale-yellow loamy find sand. The type occurs along slopes and as hillocky uplands. The material was deposited through wind action. This soil gives moderate yields of corn and oats. It is best suited to the production of truck crops, such as watermelons, cantaloupes, early peas, tomatoes, potatoes, etc.

Marshall fine sand.—The soil is a dark-brown or black rather incoherent sand of fine texture, 10 to 12 inches deep, resting on a lighter colored sand of about the same texture. The type occupies low bluffs and hills. The surface is broken and rolling and the drainage is apt to be excessive, especially where the sandy subsoil is deep. The crop value varies greatly, depending upon the condition as regards moisture. The soil is best adapted to early summer truck crops and melons, and with the aid of liberal manuring very good yields of Irish potatoes are secured.

Coloma fine sand.—The soil to a depth of about 8 to 18 inches consists of a light-brown loamy fine sand. The subsoil is a rather loose yellow loamy fine sand. In low, poorly drained situations the surface soil is sometimes dark brown or black, owing to the presence of considerable organic matter. The type occupies rolling country, rounded hills, and nearly level areas in the vicinity of streams. The soil overlies glacial till and is composed of material resulting from the reworking of glacial till by wind and water. The type is so well drained that crops are liable to suffer in dry seasons. The soil is best suited to small fruit and vegetables. Fair yields of corn and clover are made in wet years.

THE SANDY LOAM GROUP.

This group of soils supplies vegetables, small fruits, and melons for the summer markets and comprises the lightest desirable soils for general farm crops, giving early but light yields.

TABLE XXX.—*Area and distribution of the sandy loams.*

Name of soil.	State and area.[1]	Acres.
Coloma sandy loam	Mich. 1, 3, 4, 6, 7; Minn. 2; Wis. 2, 3, 5, 6, 7	554,292
Carrington sandy loam	Ill. 11; Kan. 2; Minn. 5; N. D. 3; S. D. 2	208,384
Plymouth sandy loam	N. Y. 6; R. I. 1	170,560
Waukesha sandy loam	Ind. 6; Wis. 3, 7	118,848
Bangor sandy loam	Me. 2	37,184
Knox sandy loam	Ind. 3; Iowa 2	25,984
Portage sandy loam	Wis. 3	9,792
Marshall sandy loam	Minn. 4	4,480

[1] For key to numbers in this column, see p. 253.

Coloma sandy loam.—The soil consists of a grayish-brown to brown moderately heavy sandy loam, ranging in depth from 8 to about 16 inches. The subsoil is a yellowish brown moderately heavy sandy loam. At from 24 to about 30 inches a stratum of lighter colored, coarser material is encountered. This lower stratum frequently carries a considerable amount of gravel. Fine gravel is of common occurrence throughout the soil mass. The surface configuration varies from gently rolling to hillocky, or even sharply rolling. The type has good drainage. The soil consists of residuary glacial material representing glacial till which has been reworked by wind and water and left over the unaltered material. The type is moderately well suited to sugar beets, corn, oats, wheat, grass, and potatoes. Vegetables give fairly good results. Green manuring should be practiced in order to maintain a proper supply of organic matter.

Carrington sandy loam.—The soil is a dark-brown to black heavy sandy loam, having a depth of something like 10 to 16 inches, the lower portion being somewhat lighter in color. The subsoil is usually a yellow clay loam to clay. A small amount of gravel and bowlders is scattered on the surface and disseminated throughout the soil mass. The type occupies gently rolling prairie land, frequently occurring as hillocks and sometimes as narrow ridges. It has been derived from the glacial till. It is very well suited to general farming, giving good yields of wheat, oats, flax, rye, barley, millet, and potatoes. Clover and timothy do especially well on the heavier phases.

Plymouth sandy loam.—The soil is a brown or gray, loose sandy loam, from 6 to 12 inches in depth, and containing variable amounts of gravel and rounded bowlders. The quantity of gravel and bowlders increases with depth and the interstitial material is often a gray or yellow sand. The bowlders are of trap, granite, gneiss, and other rocks of a crystalline character, together with some sandstone. The type occurs both as lenticular hills in the morainic uplands and as terrace remnants along some of the larger stream valleys, though the former features are the most typical. The topog-

raphy is rolling to hilly and kettle holes and depressions are numerous. The type has been derived from coarse-textured glacial material deposited along the morainal front, typically on Long Island and along the southern border of the New England States. On account of the porous character of the soil and subsoil the type has only low agricultural value, though tree fruits do well in selected positions.

Waukesha sandy loam.—To an average depth of about 12 inches the soil is a dark-brown to black sandy loam of loose structure, containing only a small proportion of fine gravel. The subsoil to a depth of about 24 to 30 inches is a yellowish gravelly sandy loam, the gravel usually being fine, though not infrequently including small rounded cobbles. The deep subsoil is a light yellowish, heavy, gravelly sandy loam or gravelly clay. The topography is level to gently undulating, and the type occurs both in broad extensive valley fills and as outwash plains and narrower intermorainic filled-in valleys. The soil is derived from reworked glacial material deposited by rushing glacial waters. On account of the porous nature of the subsoil drainage is often excessive and crops frequently suffer from drought except in relatively wet seasons. Under favorable moisture conditions good crops of corn, rye, hay, and potatoes are secured.

Bangor sandy loam.—The soil, to a depth of 8 or 10 inches, is a light-brown rather heavy sandy loam. The subsoil, to a depth of 3 feet or more, is a very light brown or brownish-gray sandy loam. Both soil and subsoil are filled with rounded, waterworn, and subangular stones and gravel consisting of quartz, granite, sandstone, and shale. This type occupies low hills and more level portions of higher elevations and has a rolling to slightly hilly surface. The soil is loose and friable and easily cultivated. It is best used for growing truck crops, although it is a fairly good soil for general farming in the locality in which it occurs.

Knox sandy loam.—The soil consists of a gray to dark-brown heavy sandy loam, ranging from about 6 to 12 inches in depth. This rests on a subsoil of yellowish-brown loamy sand to light sandy loam, which sometimes passes into clayey material to below 20 or 30 inches. The surface configuration is characterized by knolls and ridges, subject to shifting through wind action. The material is mainly the result of wind deposition. Fair yields of grain and grass are secured. Truck crops and some fruits give good results.

Portage sandy loam.—The soil, to a depth of from 8 to 9 inches, is a grayish-brown sandy loam of fine to medium texture. Below this occurs a brownish-yellow sandy loam grading in the lower part of the profile into a mottled gray and yellow sandy clay. The topography varies from gently rolling to nearly level, the latter areas being rather poorly drained. The type is derived from crystalline rocks, though it has been modified to some extent by glacial drift. It is

best used for vegetables and small fruits, although general farm crops do well, hay yielding 1½ tons, potatoes 100 bushels, corn 30 bushels, oats 40 bushels, and rye 10 to 15 bushels per acre. Small fruits and vegetables also thrive.

Marshall sandy loam.—The soil is a dark-brown to black compact sandy loam, about 10 inches in depth. This material rests on 6 inches of yellowish loam, slightly less sandy than the surface soil, which is underlain at from 16 to 36 inches below the surface by yellowish clay, containing a high percentage of coarse sand and gravel. Rounded pebbles and bowlders occur on the surface, while in the subsoil partly decomposed calcareous nodules are found. The type occupies gently rolling prairie ridges and intervening depressions. It is a good general farming soil—better than Miami sandy loam, owing to the higher content of organic matter. In some local areas it is inclined to be droughty. Wheat yields from 12 to 20 bushels, oats from 20 to 35 bushels, flax from 12 to 15 bushels, and potatoes from 100 to 125 bushels per acre. The best use for the type, where marketing conditions are favorable, is for vegetables to supply the medium and late summer markets.

COARSE SANDY LOAM PHASE.

A variation from the typical sandy loams, consisting of the coarse sandy loam, has been mapped in New York and Rhode Island. The phase is of considerable extent, but only of moderate importance in agriculture. Further surveys will probably show considerable extension of similar soils in the northeastern glacial region.

TABLE XXXI.—*Area and distribution of the coarse sandy loam phase.*

Name of soil.	State and area.[1]	Acres.
Carver coarse sandy loam	N. Y. 6; R. I. 1	147,712

[1] For key to numbers in this column, see p. 253.

Carver coarse sandy loam.—To a depth of about 10 inches the soil is a brown or reddish-yellow medium to coarse textured sandy loam, containing small amounts of rounded gravel. The gravel content increases with depth, and the subsoil is usually a yellow gravelly sandy loam. As a rule the surface is free from stones or large gravel. The topography is level or gently undulating, but drainage is usually good on account of the porous nature of the subsoil. The type is formed by a thin layer of loamy material overlying the coarse glacial outwash occurring along the front of the moraines. Though well drained, the type is seldom droughty, and fair yields of grass, grains, and truck crops are secured. Potatoes also yield well.

THE FINE SANDY LOAM GROUP.

This group, of relatively small extent, contains soils especially well adapted to vegetables for the midsummer market and also the best of the light soils for general farm crops.

TABLE XXXII.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Miami fine sandy loam	Mich. 2, 5, 6, 7, 8	117,312
Carrington fine sandy loam	Ind 7; Minn. 1; N. D. 8	62,464
Marshall fine sandy loam	Ind. 10; Nebr. 2; N. D. 2	48,704
Dover fine sandy loam	Mich. 4; N. Y. 4	16,448
Knox fine sandy loam	Ind. 10	4,608
Coloma fine sandy loam	Mich. 3	2,048

[1] For key to numbers in this column, see p. 253.

Miami fine sandy loam.—The soil consists of a loose, loamy, brown sand or fine sandy loam from 10 to 30 inches deep. The subsoil is a clay loam or sticky sandy loam. This type differs from the Miami sandy loam in having the heavy subsoil within 3 feet of the surface. It occupies rolling country, often occurring as rounded hills and ridges, and has good drainage. The soil is used for general agriculture. It is especially adapted to truck crops and fruit for the midsummer markets. It is also a very fair soil for corn, wheat, oats, rye, and hay.

Carrington fine sandy loam.—The soil consists of a dark-brown loamy fine sand, ranging from about 8 to approximately 18 inches in depth. The subsoil consists of lighter colored or yellow material of about the same texture. Occasionally small gravel is encountered, particularly on the crest of knolls and ridges. The topography is characterized by disconnected morainal ridges and hills. The soil is derived from the glacial till. Owing to the varied topography, the agricultural value of the type is not very uniform. Very fair yields of wheat, corn, Irish potatoes, and clover are made on the better situated phases.

Marshall fine sandy loam.—The soil consists of a dark-brown to black medium to fine sandy loam with an average depth of 14 inches. It contains a high percentage of organic matter, but this decreases with depth, as does also the dark color. The subsoil is somewhat variable, but typically consists of a yellow medium to fine sandy loam, containing a relatively high proportion of clay. The material gradually becomes heavier with depth, and grades into a mottled yellow, sticky sandy clay, which in turn is underlain by bowlder clay at a depth of 3 or 4 feet. Occasional strata of sand are encountered in the subsoil. The surface is undulating or rolling and generally favors drainage. The soil is very productive and has

a wide crop adaptation. On account of the better physical condition, induced by the high content of organic matter, it is a more productive soil than the Miami fine sandy loam. It is probably the best general purpose soil of the province. It is adapted to vegetables and fruits for the midsummer and late summer markets and for canning, as well as to the general farm crops of the locality.

Dover fine sandy loam.—The soil to 8 inches deep is a light-brown silty fine sandy loam. Beneath this occurs a yellow or reddish-yellow silty fine sandy loam which becomes sandier with depth. Both soil and subsoil have a greasy feel, owing to the presence of finely divided mica flakes. Some glacial gravel and bowlders are strewn upon the surface. The type occurs in valleys and consists of low, uneven hills and ridges, knolls, and knobs. Outcropping ledges of rock are so numerous as to interfere with cultivation. The drainage is good, and the type is somewhat subject to drought. Cedars thrive. It produces strong and lasting sod and is an excellent pasture-land type. The cultivation is limited by the rough surface and numerous rock outcrops.

Knox fine sandy loam.—The soil consists of a brown heavy fine sandy loam. Below, about 14 to 16 inches, the subsoil proper is encountered. This consists of a compact light-brown to yellow heavy fine sandy loam to fine sandy clay. At a depth of 30 inches the subsoil usually grades into coarser gravelly material. The type occupies somewhat broken to hilly country. Occasionally level areas are encountered. The soil represents wind-blown glacial material. Much of the type is excessively drained, causing crops to suffer in dry seasons. Corn, oats, wheat, and clover give moderately good returns. This soil is especially suited to the production of potatoes and other vegetables. Apples, peaches, and small fruits are grown to some extent.

Coloma fine sandy loam.—The soil to an average depth of 12 inches consists of a brown to light-brown heavy fine sandy loam, usually containing a small percentage of fine gravel. The subsoil is a yellowish, somewhat sticky, heavy fine sandy loam, also carrying some fine gravel. Below 30 inches a gravel stratum is sometimes encountered. The type occupies low ridges and hillocks, and has good drainage. Crops sometimes suffer in dry weather on account of the droughty condition of the soil. The type has originated from reworked glacial materials. Moderate yields of general farm crops are secured. Best results are had with vegetables.

THE LOAM GROUP.

The loam group contains soil adapted to vegetables for the late summer and fall markets and for canning purposes and to medium-heavy general farm crops.

TABLE XXXIII.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Carrington loam	Ind. 6, 7; Ia. 1, 3, 4; Mich. 3; Minn. 1, 4, 5; Neb. 3; N. D. 1, 2, 5, 9.	1,601,088
Volusia loam	N. Y. 1, 5, 8, 12, 15; Ohio 1	508,834
Shelby loam	Mo. 1, 8, 10, 11	424,192
Miami loam	Mich. 1, 3; Minn. 2; Ohio, 3, 10; Wis. 3, 4	384,630
Ontario loam	N. Y. 1, 7, 12	280,512
Williams loam	N. D. 10	272,256
Caribou loam	Me. 1	220,672
Flushing loam	N. Y. 6; R. I. 1	201,984
Cazenovia loam	N. Y. 8, 11	176,512
Wethersfield loam	Conn. 1; Mass. 1	109,116
Marshall loam	Ill. 6; Minn. 5; Nebr. 2	68,544
Bangor loam	Me. 2	32,576
Dover loam	N. Y. 4	28,800
Bernardston loam	Mass. 1	16,064
Gloucester loam	N. Y. 4	10,752
Easton loam	Me. 1	9,024
Mohawk loam	N. Y. 9	7,680
Judson loam	Minn. 1	3,968
Waukesha loam	Wis. 4	3,200
Coloma loam	Wis. 7	2,880

[1] For key to numbers in this column, see p. 253.

Carrington loam.—The soil is a dark-brown to black mellow loam, ranging in depth from about 10 to 14 inches. The subsoil consists of a yellowish-brown, somewhat more compact loam, which at lower depths frequently grades into a heterogeneous stratum of clay, sand, gravel, and bowlders. The type occupies undulating to rolling country. The soil consists of residual material derived from glacial till. While extensive areas are well drained and admirably suited to farming, there are occasional small areas of obstructed drainage, comprising bogs, ponds, and swampy depressions, which are unfit for cultivation without the construction of drainage outlets, which in many cases would be very difficult to supply. The type is admirably suited to general farming. Wheat, corn, oats, barley, and flax are the principal crops.

Volusia loam.—To a depth of about 8 inches the soil of the Volusia loam is a dark-brown loam, containing a considerable quantity of flat shale and sandstone fragments and a large quantity of finely divided shale chips, popularly called "shale gravel" or "black gravel." The subsoil is a yellow or mottled yellow and gray slightly silty loam, also carrying large quantities of fragments of shale and sandstone rock. The subsoil may rest either upon the underlying rock or upon deposits of sand or broken shale. The type is derived, through feeble glaciation, from the underlying shales and sandstones. The surface is generally less rolling than that of a greater part of the Volusia

silt loam. For the most part the surface drainage is adequate. The soil is very well adapted to the production of grass, oats, buckwheat, and, in the less elevated portions, corn. Apples are grown to advantage throughout a considerable part of its extent for the fall and winter markets, and the soil is well adapted to vegetables for the late summer or fall markets, depending upon elevation, and for canning purposes.

Shelby loam.—The type consists of a fine sandy or silty loam of a gray or brown color, from 3 to 8 inches deep, grading into a reddish-yellow sandy clay which extends to a depth of 3 feet or more. It is locally termed "white-oak lands." Iron pipes and concretions are usually found in the soil. The subsoil is made up mainly of pockets of sand and clay with occasional thin lenses of cherty gravel. The material giving rise to this type occurs below that giving the Shelby silt loam, and is exposed through stream cutting and erosion of the overlying prairie. The type occupies steep slopes adjacent to the water courses. The native growth is white oak and scrub oak, with a scattering of red oak and hickory. It is much less productive than the Shelby silt loam. On account of its poor structure it is poorly adapted to farm crops or vegetables, and is used almost exclusively for pasture.

Miami loam.—The soil consists of a light-brown to dark-gray rather mellow loam, about 12 inches deep, sometimes becoming lighter in color with depth. The subsoil is a compact yellow sandy clay, frequently carrying stones and gravel. Often, at a depth of from 14 to 25 inches, gravelly material is encountered. A few bowlders and pebbles are usually found on the surface. The type occupies level to rolling upland and is fairly well drained, except in some of the level areas. The soil is very productive, especially suited to corn, wheat, hay, and potatoes, to canning crops, and to fruit, particularly apples for the winter market. Small fruits, such as strawberries and raspberries, do well.

Ontario loam.—The soil is a grayish-brown loam about 9 inches deep, containing from 20 to 50 per cent of small rounded cobblestones and bowlders of crystalline rock. Subangular fragments of shale and limestone also occur mixed with the soil and subsoil over portions of the type. The subsoil is usually a compact loam of brown or reddish-brown color and often slightly mottled. The topography for the most part is rolling to hilly, especially where it occurs in the drumlin areas of western New York State. The type is derived from weathering of glacial drift. It is usually well drained, while the retentive character of the subsoil enables it to conserve moisture for crops. Good yields of corn, oats, potatoes, and vegetables are secured, and it is well adapted to tree fruits, especially apples and cherries.

Williams loam.—The soil consists of a dark-brown loam or heavy loam about 16 inches deep. The subsoil is a whitish calcareous loam reaching to a depth of more than 3 feet. The dark color of the surface soil is due to the presence of organic matter. Both soil and subsoil may contain a small percentage of gravel and bowlders, and in places the subsoil at lower depths passes into a mass of subangular bowlders and clay or clay loam. The type rarely continues uniform over any extensive stretch of country. It occupies areas nearly level to rolling. The principal crops are wheat, flax, and, to a lesser extent, oats, barley, rye, and millet.

Caribou loam.—The type consists of a hazel-brown silty loam having an average depth of about 10 inches and resting upon a stratum of yellow silty loam, which, at a depth of from a few inches to 2 feet, passes into the lower till consisting of a gray or grayish-yellow silty loam. In places this material comes within a few feet of the surface, in which case the yellow stratum is lacking. Small, more or less rounded fragments of sandstone, gneiss, granite, and quartzite are found in both soil and subsoil, but are more numerous in the latter. Almost the entire type is underlain at a depth ranging from a few inches to several feet by a calcareous shale, many small fragments of which are distributed throughout the soil and subsoil. As a rule the soil is friable, free from large bowlders, well drained, and well suited to cultivation. It is an upland type occupying swells and ridges and extending down the stream slopes to or nearly to the streams. The type is glacial in origin, but the material is largely local, having been derived for the most part from the underlying shaly limestone. The native vegetation consists mainly of hardwoods such as maple, ash, yellow birch, and beech, though there is a scattering of spruce and fir. This soil is admirably suited to Irish potatoes, grass, oats, and barley. The potatoes are of fine quality, late in maturing, on account of the high latitude, and are well suited for storage for the late winter markets.

Flushing loam.—The soil is a friable brown loam from 8 to 14 inches in depth and underlain by a yellow or reddish silty or fine sandy loam extending to a depth of 30 inches, where micacious yellow sand is usually encountered, though in some cases the material may rest upon bed rock of a crystalline character. The type is developed upon glacial moraine, and the character of the topography varies from hilly to low, with sags or depressions intervening between the hills and upon the plains. The type is derived from weathering of the glacial material without the intervention of any great amount of water or wind action. The character of this glacial material is granitic. Grass is the principal crop, with corn next in importance. Where not too rough it is a very strong agricultural soil.

Cazenovia loam.—The soil is a brown loam to a depth of 12 inches, containing some gravel and fragments of limestone and red sandstone. The subsoil is a brown or a reddish clay loam resting on limestone or shale at about 3 feet. Occasionally large bowlders are scattered over the surface. It occupies high rolling hills and tablelands and is quite uniform in character over large areas. It is derived from the weathering of glacial material deposited as terminal or ground moraines, which is in many instances comparatively thin over the underlying limestone and shale, which has contributed considerable material to the drift. The principal crops are grass, alfalfa, corn, potatoes, and wheat, good yields being usually secured.

Wethersfield loam.—The soil is a red or reddish-brown fine sandy loam, about 14 inches deep, resting on a somewhat heavier sandy loam, which is dark Indian red in color. Both soil and subsoil contain large numbers of angular bowlders and undecomposed rock fragments, varying in quantity from 5 to 50 per cent and in size from a few inches to several feet. The surface of the type is hilly in some instances, though more often rolling and amenable to agriculture. It has been derived through glacial action from the Triassic formation, and where the stones are not too numerous or have been removed good crops of heavy bodied tobacco, corn, wheat, and grass are produced.

Marshall loam.—The soil is a dark-brown to black loam, 10 to 12 inches deep, resting on a lighter-colored loam or heavy loam. The deep subsoil consists of clay, sand, gravel, and bowlders mingled together. Glacial bowlders are found here and there on the surface, in some areas being so plentiful as to interfere with cultivation. The type occupies gently undulating to rolling country and covers wide areas in the prairies of the Northwest. While extensive areas are well drained and well suited to farming, there are other areas where drainage has been obstructed, resulting in bogs, ponds, and swampy depressions unfit for cultivation without artificial drainage. The soil is excellent for general farming purposes. Wheat, oats, corn, barley, and flax are the principal crops. It is adapted also to the production of vegetables for canning purposes.

Bangor loam.—The surface soil to a depth of 8 or 10 inches is a light grayish-brown silty loam. The subsoil to more than 3 feet is a yellowish-gray or drab loam. A shallow phase, occurring chiefly at higher elevations, has 6 to 10 inches of a brownish-yellow silt loam overlying a somewhat more compact brownish-yellow or drab-gray subsoil of about the same texture and averages less than 3 feet deep. Both soil and subsoil contain many rounded and subangular granite, quartz, and shale bowlders, stones, and finer gravel, the proportion of shale fragments being greater in the shallow phase. The topography is rolling to hilly. The deeper areas are a fair soil for general

farm crops, but the shallower phase has a low agricultural value and a considerable part of it is in forest and pasture.

Dover loam.—The soil, to about 8 inches, is a light-brown to dark-brown friable, granular loam or silt loam. The subsoil, to 36 inches or more, is a yellowish material of the same texture as the soil. Sometimes both soil and subsoil are reddish. Gravel and blocks of limestone are usually strewn upon the surface. The type occurs in valleys and the surface is made up of low hills and ridges and numerous outcropping ledges of limestone. The drainage is good. The type is largely residual from underlying limestone, but is partly glacial. The cedar is a characteristic tree growth. This type is a strong general farming soil and is especially prized for pasture. It is an excellent soil for corn, oats, wheat, and hay, and is fairly well adapted to the production of apples and fruits.

Bernardston loam.—The type is a light clayey or silty loam of dark color, 10 inches in depth, underlain by about 14 inches of dark-yellowish loam grading into a dark slaty blue clay loam of very compact nature. It occurs in very broken and hilly areas and outcrops of the underlying argillaceous rocks are very common. Cultivated areas of the soil occur very largely in drumlinoid hills. The native vegetation is made up chiefly of hardwoods, particularly sugar maple, but in the more stony areas, where the soil is shallow, chestnut, pine, and hemlock are common. The type is composed of argillaceous rock material. It is very productive, being fine for grass and grazing. It also produces good crops of corn, oats, and rye. The topography is too rough for economical production of vegetables on a large scale, but it may be used for fruit where the market conditions are favorable.

Gloucester loam.—The soil, to a depth of 8 inches, is a light-brown to dark-brown silty loam with a slightly gritty though sometimes soapy feel, the latter peculiarity being due to the presence of finely divided mica flakes. The subsoil is a yellowish, compact, silty loam to about 20 inches, below which occurs broken rock or bedrock. A few rock fragments are strewn upon the surface and through the soil and subsoil. Areas of this type of soil occupy the tops and slopes of high ridges and have good surface drainage. It is regarded as cold, wet, late land, owing to the compactness of the subsoil, and would be improved by drainage. It is an excellent soil for timothy, redtop, and clover, and makes good pasture land. It is fair soil for orcharding in well-drained locations.

Easton loam.—The type consists of an ashy-gray or nearly white silt loam, underlain to a depth of 10 inches by a mottled gray and yellow silty loam, the yellow color becoming more prominent until at about 36 inches only a slight mottling of gray is discernible. Frequently a layer of sticky yellow clay is encountered at from 20 to 30

inches below the surface. Usually the soil and subsoil carry a large number of angular glacial bowlders, rock fragments, and considerable small sandstones and shale gravel. When dry the surface has a decided whitish floury character, which is due to the presence of glacial-ground rock. The type occurs as flat, depressed areas in the larger bodies of Caribou loam and as narrow strips bordering Muck areas. In its present condition it is poorly drained and rather difficult to handle. The soil is of glacial origin and owes its characteristic light color to an advanced stage of weathering or to an alteration of the upper till through subjection to alternate wet and dry stages. When properly drained fair yields of a rather inferior grade of potatoes are secured. Oats and grass succeed fairly well, but the latter is inclined to winterkill.

Mohawk loam.—The soil, to a depth of 10 inches, is a brown to brownish-gray loam. The subsoil from 10 to 36 inches is a heavy brown loam, becoming increasingly heavy with depth. Both soil and subsoil contain some glacial stone and gravel. The topography is usually hilly. This is a good soil for corn and oats, a fair soil for potatoes for the fall and early winter market, and for vegetables to supply the late market and canning factories.

Judson loam.—The soil consists of a mellow black loam varying in depth from a few inches to 3 feet or more. The subsoil is yellowish-brown clay loam or unaltered glacial till. The type occurs either along the gentle slopes of stream valleys or near the foot of these slopes. It is admirably suited to the culture of fruit, especially apples. Only a small part of the type is under cultivation. Good crops of corn, wheat, cabbage, and potatoes are grown.

Waukesha loam.—The soil is a dark-brown to black heavy sandy loam to sandy clay, containing some fine gravel. The subsoil is usually yellow or yellowish-gray. The type occupies gently rolling areas and slopes. The soil material represents residuary products left through the reworking of glacial till by wind and water. This is a very desirable trucking soil, and will give good results with small fruits, hay, barley, and corn.

Coloma loam.—This is a brown loam, 10 inches deep, underlain by a yellow-brown to yellowish loam of progressively heavier texture to a depth of 18 inches, where it merges into sticky, sandy loam or gravelly loam. It is gently rolling in topography and is derived from glacial material deposited in the form of moraines. The drainage is good and yields of staple crops are fair.

THE SILT LOAM GROUP.

The silt-loam group covers two-fifths of that part of the province so far surveyed and is three times as large as any other group of soils

in the province. It contains some of the great corn and wheat soils of the United States. The soils are heavy to work, but exceedingly productive when properly handled. They require a heavy equipment of teams, implements, and buildings. As a group they give heavy yields of vegetables and fruits, maturing late and having excellent qualities for canning and for storage for winter and spring markets. They also give large yields of various farm crops, which vary according to locality, and dairying comes in as an important industry.

TABLE XXXIV.—*Area and distribution of the silt loams.*

Name of soil.	State and area.[1]	Acres.
Marshall silt loam	Ill. 2, 5, 6, 8, 9, 11; Ind. 3, 10; Ia. 4; Kans. 2, 3, 5; La. 6; Mo. 1, 4, 9; Neb. 1, 2, 3, 5, 6; Wis. 6.	4,084,230
Knox silt loam	Ill. 3, 5, 6, 7, 8, 10, 11; Ind. 2, 3, 8, 10; Ia. 2, 4; Ky. 5; Mo. 4, 7, 9; Nebr. 5; Wis. 6.	1,881,024
Memphis silt loam	Ill. 4, 7, 9; Ky. 1; La. 6; Miss. 3, 4, 5, 9, 14, 15; Mo. 7; Tenn. 8.	1,863,290
Carrington silt loam	Ind. 10; Minn 1, 5; N. D. 2, 5; S. D. 2; Wis. 2	739.584
Marion silt loam	Ill. 1, 2, 9; Mo. 7	695,040
Volusia silt loam	Ind. 9; N. Y. 2, 3, 5, 8, 9, 12; Ohio 10	656,384
Putnam silt loam	Mo. 8, 10, 11	402,112
Lexington silt loam	Tenn. 6, 8	342,272
Richland silt loam	La. 5; Miss. 4	148,928
Dutchess silt loam	N. Y. 4, 14	129,984
Miami silt loam	Ill. 2; Ind. 10; Wis. 2	93,056
Carroll silt loam	La. 5	83,584
Mohawk silt loam	N. Y. 9	45,440
Scottsburg silt loam	Ind. 9	37,184
Safford silt loam	Tenn. 6	28,544
Portage silt loam	Wis. 3	22,656
Caribou silt loam	Me. 1	10,176
Carver silt loam	R. I. 1	4,928
Judson silt loam	Mo. 1	3,072
Hamburg silt loam	Mo. 1	3,008

[1] For key to numbers in this column, see p. 253.

Marshall silt loam.—The type consists of a dark-brown to black silt loam rich in organic matter, 15 inches deep, resting usually on a light-colored, sometimes mottled, silty loam or silty clay. Lime concretions frequently occur. The type varies in topography from level to rolling and hilly. Drainage is generally good, the subsoil retaining moisture well and crops resisting drought to a marked degree. It is unquestionably the most important corn soil in the United States. In the Northwest it is the most important wheat soil for spring wheat. According to locality, as modified by both market conditions and climate, it is a most important soil for oats, alfalfa, sugar beets, is well adapted to late crops of pears and apples for the winter markets, and, in a few localities, to cigar tobacco. It is admirably adapted to dairying and to vegetables for the

fall and winter markets. Covering as it does two-fifths of this, the largest group in the province, it has for a long time dominated the agriculture of the Central and Northwestern States.

Knox silt loam.—The soil is a light-brown to ashy gray or nearly white silt loam, having an average depth of about 10 inches. The subsoil is a compact light-brown to pale-yellow silt loam to silty clay. It occurs as rolling to hilly areas, which originally supported hardwood timber growth. The soil is the result of wind-deposited glacial material. It produces good yields of wheat, corn, clover, and grass. Certain fruits and vegetables, as Irish potatoes, give profitable returns.

Memphis silt loam.—The soil is a yellow or brown silt loam, 8 inches in depth, powdery when dry. Under this is a chocolate-brown or yellow compact silt loam, which in turn is underlain at a depth of from 2 to 6 feet by a yellow silt or loess formation. The type occupies uplands and is subject to serious erosion. It is largely forested to oak, hickory, and beech. Good yields of cotton, corn, wheat, oats, hay, and potatoes are secured in noneroded areas. In northern areas the soil is good for fruits and vegetables. It requires very thorough cultivation.

Carrington silt loam.—The soil consists of a dark-brown to black silt loam, having an average depth of about 12 inches. The subsoil is a yellowish-brown to pale-yellow silty clay loam or silty clay. The surface configuration in the main is nearly level to undulating. The soil is composed of materials derived through weathering from glacial till. It is admirably adapted to general farming, including wheat, corn, oats, barley, rye, flax, and grass.

Marion silt loam.—The soil consists of silt loam of light-brown or white color, with an average depth of 12 inches. The subsoil is a hard, stiff, silty clay of mottled appearance, locally known as "hardpan," the predominating colors being gray, light yellow, and reddish yellow. Between the soil and subsoil occurs a white layer of compact silt which crumbles easily between the fingers. The type occupies level prairie land. The soil has a poor structure for agricultural purposes, as crops suffer in summer for lack of moisture. Early crops of wheat do well and it is better adapted to this than to corn. It is also adapted to apples, which have fine quality, but because of its structure it gives a crop only about two years out of five.

Volusia silt loam.—The soil of the Volusia silt loam, to an average depth of 8 inches, is a gray to brown silty loam. The subsoil, to a depth of about 2 feet, is a light-yellow silty loam, which below 2 feet usually becomes mottled with gray or drab. Both soil and subsoil contain a high percentage of flat fragments of shale and sandstone from 6 inches to one or more feet in breadth. The subsoil usually rests upon shale or sandstone rocks, which may occur at any depth

between 18 inches and 3 or 4 feet. The type is derived from the weather products of the shale and sandstone, reworked by glaciation, and to a small degree modified by material brought in through glacial action. It occupies rolling and hilly land and is frequently interrupted or bordered by steep slopes not suited to agriculture. The Volusia silt loam where properly cultivated is a good soil for timothy and small grains. In the eastern part of the region where it occurs it lies at too high an elevation to be well adapted to corn. In this locality buckwheat and potatoes may be grown to advantage.

Putnam silt loam.—The type consists of a surface soil of dark-gray to almost black silt loam, from 6 to 10 inches deep, underlain by a stiff impervious brown or drab mottled silty clay streaked with blue and red. A thin layer of white silt is often found between soil and subsoil. This type resembles both the Marshall and Marion silt loams. It differs from the former in having a heavy, impervious subsoil and from the latter in the darker color of the surface soil. It is derived from a deposit of loess over glacial material. The type is known locally as "the prairie," and occupies level to gently rolling uplands. The greater part is fairly well drained, but the impervious subsoil allows water to collect on very level areas after heavy rains. The principal crops on this type are hay, corn, oats, and wheat, with millet, Kafir corn, and sorghum as secondary crops. Fruit also does well, and the production of apples is of some importance.

Lexington silt loam.—The soil, with a depth of about 12 inches, is a gray or yellowish-gray mellow silt loam. The subsoil to a depth of 36 inches is either a compact silt loam, slightly heavier than the soil, or a silty clay, varying from yellow to brown in color, or sometimes tinged with red. The surface is moderately rolling or hilly, the rougher portions being largely the result of erosion. The drainage is good. Crops suffer during extended droughts. The type is derived from loess and closely resembles the Memphis silt loam, but the deposit of loess is very thin and the soil is in places modified by the underlying Orange sand formation. The soil is adapted to corn, cotton, forage crops, vegetables, and strawberries. The natural forest growth consists of white, red, post, and black-jack oak and chestnut, hickory, and black gum.

Richland silt loam.—The surface soil, to an average depth of 12 inches, consists of brown or light-brown silt loam. The subsoil is a chocolate-brown silt loam, more compact than the surface soil, and contains a higher percentage of clay. This material in turn is underlain by a considerable layer of yellow silt or the loess formation. The type occurs on the uplands in the "flat hill" portion of the loess area. Natural drainage is good. Some of the fields are badly washed, but the type is nowhere so deeply eroded as the Memphis silt

loam. It gives fair yields of cotton and corn, and in some localities it is also used for the production of strawberries, cabbage, Irish potatoes, and other truck and fruit crops. It is distinguished from the Memphis silt loam by more level topography, less general erosion, and uniform existence of the complete soil and subsoil section underlain by the loess. It will be found throughout the "flat hill" region of the loess covering the upland adjacent to the Mississippi River and its tributaries south of the Ohio River.

Dutchess silt loam.—The type consists of a light-brown friable loam, 8 to 10 inches deep, underlain by a rather compact, impervious silt loam, the color of which grades from light brown to yellowish. Below 36 inches the color often changes to drab and blue. Usually there is a large quantity of rounded rock fragments on the surface and in the soil and subsoil. The type is derived principally from glacial material, but is influenced in places by the nearness of the underlying rocks, which are of variable constitution. It forms the surface of rounded drumlinoid hills and ridges, which have only fair drainage. The soil is, as a rule, cold, wet, and late, and is improved by tile drainage. When suitably drained it is a good general farming soil and well adapted to grass, hay, pasture, and ensilage corn. It is a fair type for wheat, rye, oats, and potatoes. Apples, peaches, and plums do well. It is a good soil for dairying.

Miami silt loam.—The soil is a light-brown to pale-yellow or gray silt loam, averaging about 10 inches in depth. The subsoil is a yellowish-brown compact silt loam to silty clay. The type occupies rolling to hilly, originally timbered areas. It consists of the weathered product of glacial till. Good yields of wheat, corn, clover, and grass are secured. Fruits and certain late truck crops, including potatoes, do very well.

Carroll silt loam.—The soil of this type is a light-gray silt loam 8 or 10 inches deep, underlain by a compact, impervious, heavier subsoil of slightly darker color, which is more or less mottled with yellow and brown iron stains. Numerous iron concretions are sometimes found in the subsoil. The type occurs as a broad, flat belt contiguous to the Memphis silt loam and as narrow strips of "slash land" within the latter type. The drainage is naturally poor and during the winter and spring months much of the area is covered by shallow water. The type represents deposits of loess which have been subjected to very poor drainage conditions. It contains little organic matter and is little under cultivation, most areas being covered with a heavy growth of oak and an undergrowth of palmetto. Its best use is probably for reforestation, though after extensive reclamation it would be a good rice soil.

Mohawk silt loam.—The soil consists of 8 inches of light-brown silt loam. The subsoil, to a depth of 36 inches, is a heavy silt loam

grading into a clay loam. The deep subsoil is frequently mottled with yellow, brown, and gray. The topography is rolling to hilly. The surface drainage is usually good, but the subsoil drainage is frequently poor on account of the texture and compactness of the subsoil. This is a general farming soil of moderate strength, yielding corn, oats, grass, hops, and wheat in moderate quantities. It is also, when well drained, a fair apple soil. Its best use, under good methods, is for dairy farming.

Scottsburg silt loam.—The surface soil is an ashy-gray silt loam. At about 10 inches it grades into a light-yellow or slightly mottled silt loam, which becomes gradually heavier and more compact as the depth increases, until, at 30 to 36 inches, is found a heavy silt loam of a drab-gray color, slightly mottled with yellow stains. Small iron concretions are present throughout the entire depth of soil and subsoil. The areas were probably at one time level, but have been eroded by stream action until they present a gently rolling topography. The soil is best adapted to tomatoes and other vegetables and to small fruits. By adding humus and adopting crop rotations and employing heavier teams, general crops, suited to the locality, may be made to do well.

Safford silt loam.—To a depth of 8 to 10 inches the soil consists of a gray or light-yellow silt loam. This is underlain by a tough, plastic clay or clay loam of a red or reddish-brown color, grading at a depth of about 3 feet into greensand. The surface soil is loose and rather incoherent when dry and is easily cultivated. The type has a rolling to hilly topography and washes badly if not properly managed. The natural drainage is good. The silt loam covering is derived from a deposit of loess, while the subsoil is the result of the weathering of the greensand marl, a shallow deposit of clayey material above the marl or a mixture of both. The soil is adapted to corn, cotton, wheat, and hay, and to truck crops and melons. The timber growth consists of white, red, black-jack, and post oak, chestnut, and some hickory and beech.

Portage silt loam.—The type consists of a grayish-colored silt loam 8 or 10 inches deep, underlain by a mottled gray and yellow heavy a clay loam. At a depth of about 25 inches there frequently occurs a thin stratum of sand, sandy loam, or sandy clay, grading quite abruptly into a dark-red clay. The type occupies level or slightly undulating areas, is rather poorly drained, and sometimes marshy. It is well adapted to general farm crops, small fruits, and vegetables for the late markets and for canning.

Caribou silt loam.—The soil, which has an average depth of 10 inches, consists of a yellowish-brown to hazel-brown silt loam. The subsoil is a brighter yellow silty loam, which may continue throughout the limits of the soil profile or may, in the lower portion, pass

into the grayish silty loam of the lower till. Calcareous shale is encountered at from one to several feet. There are many small shale fragments and a few small stones throughout the soil and subsoil. The type contains fewer stones than the Caribou loam. It occupies ridges, slopes, and flat areas and has good drainage. It is one of the best soils for potatoes, the crop maturing late and having exceptionally good keeping qualities. The soil is well adapted to wheat, oats, corn, and hay, and fairly well adapted to fruit and vegetables for the late markets.

Carver silt loam.—To an average depth of 10 inches this is a brown silty soil containing very little coarse material. The subsoil is a uniform plastic yellow silt loam resting at about 32 inches upon a substratum of coarse sand and gravel. Except for a few glacial erratics, the type is free from stones and gravel. The topography is level to gently undulating and the type is usually well drained. It is glacial material reworked by wind or glacial waters. It is well suited to the ordinary farm crops and particularly to vegetables and the heavy truck and canning crops as well as to fruit. The soil is easily kept in good physical condition and responds readily to improved farm methods.

Judson silt loam.—The type consists of a dark grayish-brown silt loam of somewhat variable depth, but averaging about 20 inches, underlain by a similar-textured, lighter-colored subsoil. It occurs as a strip of varying width at the upper side of the stream bottoms along some of the larger rivers in the Glacial and Loessial region. The soil is of colluvial origin, being formed in larger part by the talus which has moved downward from the bluffs. It lies above overflow, and is a very productive type, well adapted to corn, wheat, and alfalfa.

Hamburg silt loam.—The type represents the material forming the immediate loess bluffs, from a few rods to half a mile or so in width, along some of the large rivers of the Central West. The soil is a grayish-yellow to light-brown fine floury silt of loose structure. It is underlain by a subsoil possessing practically the same characteristics, though sometimes mottled and containing iron and lime concretions and iron pipes. The surface material is subject to more or less drifting by the winds. While essentially loose in structure, the undisturbed deposits are remarkable for their ability to maintain vertical exposures along the bluff lines. These loess deposits range from a few to 200 feet or more in thickness, and the topography is generally so rough as to preclude agricultural operations, while generally, under prairie conditions, the type is sometimes forested. On account of its unfavorable topographic position it is of little agricultural value.

THE CLAY LOAM GROUP.

The clay loam group, including the black clay loam phase, requires a very heavy farm equipment. The soils are adapted to corn, wheat, oats, and hay and to the intensive form of dairying where the animals are fed throughout the season with a minimum of pasturing. Fruit does well for the late storage markets.

TABLE XXXV.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Miami clay loam	Ind. 1, 4, 5, 6; Ia. 3; Mich. 1, 2, 5, 6, 7, 8; Ohio 2, 3, 4, 7, 9, 10; Wis. 4.	2,281,482
Carrington clay loam	Ia. 1, 3; Minn. 1, 5; N. D. 8; Wis. 4	612,864
Mohawk clay loam	N. Y. 9	67,200
Volusia clay loam	N. Y. 12	5,952

[1] For key to numbers in this column, see p. 253.

Miami clay loam.—The type consists of 10 inches of a yellowish gray to light-brown somewhat silty loam, underlain by light-brown to yellow, sometimes mottled, stiff silty clay loam or clay, which is in turn underlain by bowlder clay at depths varying from 5 to 10 feet. Stones and erratic bowlders are found on the surface, but in no great quantity except in small areas. The type occupies uplands and the surface is level to gently rolling, except near streams, where it becomes hilly and broken. The flat interstream areas generally require artificial drainage. The soil is adapted to general farming, especially to wheat, oats, hay, and ensilage crops, dairy farming, the heavy vegetables for winter use, and apples for the winter market.

Carrington clay loam.—The soil is a black clay loam which usually has a depth of 12 or 14 inches. The subsoil is a yellow, slightly plastic silty clay. The topography is nearly flat to undulating and the drainage good. The type represents material derived from glacial till. It is an ideal corn, wheat, oat, and grass soil.

Mohawk clay loam.—The surface soil consists of 9 inches of heavy silty clay loam, with a dark-brown or grayish-brown color. From 9 to 24 inches the material is a lighter brown silty clay loam. Usually below 24 inches this grades into a stiff clay loam, not infrequently dark colored from the presence of some partly decomposed calcareous shale and limestone fragments. The topography is rolling to hilly and ridgy. The surface drainage is good, but the subdrainage is frequently poor. This is an excellent grass, corn, and clover soil. It also produces good yields of oats. It is not well suited to potatoes and root crops. It is an excellent soil for intensive dairying.

Volusia clay loam.—The soil, to a depth of about 8 inches, is a dark-yellow or brown heavy loam or clay loam. The subsoil is a

pale-yellow or drab clay loam. Both soil and subsoil contain a considerable quantity of shale and sandstone chips and sometimes larger pieces of stone. Some large erratic bowlders occur, but these are not abundant. The deep subsoil is locally called "blue clay." The surface is rolling and irregular and sometimes morainal in character. The soil is generally in need of drainage, but when drained it is a strong soil for wheat, rye, buckwheat, corn (where the elevation is not too great), for dairying, and for the production of vegetables and fruits for canning and winter storage.

BLACK CLAY LOAM PHASE.

Soils of the black clay loam phase form important agricultural land in the prairies of the Middle West. As will be seen in the following table, the phase has been found in a number of different areas in Illinois, Indiana, Michigan, Iowa, and Ohio. These surveys indicate very extensive distribution of similar soil over the States mentioned.

TABLE XXXVI.—*Area and distribution of the black clay loams.*

Name of soil.	State and area.[1]	Acres.
Marshall black clay loam.....	Ill. 5, 6, 8, 10; Ind. 10	228,224
Carrington black clay loam....	Ind. 1, 4, 5, 6, 7; Ia. 1; Mich. 6, 7; N. D. 5; Ohio 2, 4, 7, 9....	210,512

[1] For key to numbers in this column, see p. 253

Marshall black clay loam.—This type is a black clay loam, 10 to 12 inches deep, underlain by a tenacious drab clay. It is generally level and the natural drainage is poor. When thoroughly drained it is very productive, particularly for corn. It is one of the great corn soils of the Central States. It is less well adapted to wheat, but is very well adapted to hay and dairying and to the heavier truck crops and fruit for the winter markets.

Carrington black clay loam.—The soil, which is a black clay loam of high organic matter content, is underlain at about 10 or 12 inches by tenacious dark-gray or drab silty clay. It occurs generally as level or depressed areas, having insufficient drainage outlets. It represents residual material derived from glacial till and subjected to poorly drained conditions, under which large quantities of organic matter have accumulated in the soil from the decay of water-loving plants. When well drained the type is extremely productive. The best results are had with corn and grass. Grain crops make such rank growth as to cause lodging.

SOILS OF SUBORDINATE VALUE.

Soils, consisting mainly of gravel, gravelly sand, stony sand, gravelly sandy loam, stony sandy loam, gravelly loam, stony loam, and slate loam, are treated here in a separate group, because from their very loose and open texture, often combined with rough topography, they have little agricultural value and can not be adapted to important use economically at the present time. The peculiarities of the several types and the use that can be made of them are indicated in the descriptions which follow:

COARSE SAND.

TABLE XXXVII.—*Area and distribution of the coarse sand.*

Name of soil.	State and area.[1]	Acres.
Carver coarse sand	N. Y. 6; R. I. 1	28,160

[1] For key to numbers in this column, see p. 253.

Carver coarse sand.—This is a light-brown or yellowish sand of usually coarse texture and containing a small amount of fine gravel. The soil is about 6 inches deep and is underlain by yellow or orange sand containing slightly larger amounts of gravel and of more porous structure. The type occupies level plains, long, narrow ridges, and steep valley walls. It is derived from the coarser sediment of glacial outwash plains, the coarser material consisting largely of granite and other crystalline and sandstone rocks. The natural growth is scrubby pitch pine and wild grasses and the type is naturally a poor, unproductive soil.

GRAVELS.

TABLE XXXVIII.—*Area and distribution of the gravels.*

Name of soil.	State and area.[1]	Acres.
Judson gravel	Ill. 10, 11; Wis. 2	15,296
Coloma gravel	Wis. 4	6,080
Carrington gravel	Minn. 4; N. Dak. 1	2,560

[1] For key to numbers in this column, see p. 253.

Judson gravel.—The type consists of dark-colored sandy gravel, underlain by lighter-colored material, having usually a higher content of clay. The content of gravel ranges so high that the soil is inclined to be excessively droughty. It usually occupies steep slopes and represents outcropping or colluvial material derived from a

gravel stratum of glacial till. Near the foot of slopes there may be bends of colluvial gravelly soil of a somewhat more loamy nature. The major part of the type has low agricultural value. Some fruit can be grown successfully in the less steeply inclined situations.

Coloma gravel.—The soil consists of brown sandy loam, ranging in depth from about 8 to 16 inches. The subsoil is a heterogeneous mixture of sand, gravel, and bowlders. The type occurs as well-rounded hills or knolls and as narrow, choppy ridges. The material represents residuary products derived from the reworking of glacial till by wind and water. The loose character of the material and rough surface configuration render the type practically non-agricultural. The greater portion is timbered with hardwood and is used for pasturage.

Carrington gravel.—The soil is a dark-brown to black sandy loam, containing a large proportion of coarse sand and fine gravel. At a depth of from about 8 to 18 inches this is underlain by a stratum of coarse sand and fine gravel usually several feet in thickness. The type occurs as knolls and ridges and is found capping high elevations. The soil is derived from glacial till. On account of susceptibility to drought the agricultural value of the soil is low.

GRAVELLY SAND.

TABLE XXXIX.—*Area and distribution of the gravelly sand.*

Name of soil.	State and area.[1]	Acres.
Coloma gravelly sand	Mich. 1, 6, 7; Wis. 7	26,762

[1] For key to numbers in this column, see p. 253.

Coloma gravelly sand.—This type consists of a brown gravelly sand, which at a depth of about 8 to 12 inches passes into a yellow coarse sand usually containing a considerable amount of fine gravel. It occupies high ridges and knolls. The drainage is so thorough that crops are inclined to suffer in dry weather. This soil consists of glacial material, reworked by wind and water and left as a deposit over glacial till.

STONY SANDS.

TABLE XL.—*Area and distribution of the stony sands.*

Name of soil.	State and area.[1]	Acres.
Coloma stony sand	Mich. 1, 7; Wis. 3, 7	26,166
Plymouth stony sand	N. Y. 6	5,376

[1] For key to numbers in this column, see p. 253.

Coloma stony sand.—The soil to an average depth of about 8 inches consists of a light-brown or yellow medium sand. The subsoil is a loose yellow medium sand. Stones are so abundant and the topography so rough that the type has little agricultural value. The soil represents residuary material, consisting of products left upon the reworking of glacial till by wind and water. Rye, buckwheat, corn, and grass are grown on some of the smoother areas, but the yields are small. The type is best suited to pasturage and forestry.

Plymouth stony sand.—The type is characterized by a gray or brown sand of coarse or medium texture, in which occurs considerable quantities of fine gravel and scattered bowlders. The subsoil is a yellow, gravelly sand, passing at 18 inches into coarse sand, gravel, and stone. Some portions of the surface material are usually of wind-blown origin, while the lower subsoil is glacial. The type is developed upon moraines and the topography is rolling to hilly. The soil is so porous and leachy as to be of little agricultural value.

GRAVELLY SANDY LOAMS.

TABLE XLI.—*Area and distribution of the gravelly sandy loams.*

Name of soil.	State and area.[1]	Acres.
Coloma gravelly sandy loam	Ind. 6, 10; Mich. 2, 3, 6, 7; Minn. 2	40,768
Carrington gravelly sandy loam	N. Dak. 9	10,048

[1] For key to numbers in this column, see p. 253.

Coloma gravelly sandy loam.—The soil consists of a brown gravelly sandy loam having an average depth of about 10 or 12 inches. The subsoil is quite variable in texture, ranging from sandy loam to fine gravel. Small rounded stones are of common occurrence on the surface and throughout the soil. The lower subsoil quite often consists of loose gravel. The type occupies hilly to rough country, and usually embraces many knolls and ridges. The type is derived from reworked glacial till. General farming is practiced on much of the type, and fair crops are produced. Wheat, oats, corn, and hay are most commonly grown. The type is a desirable soil for peaches, apples, grapes, and small fruits. Potatoes and a number of vegetables also give good returns.

Carrington gravelly sandy loam.—The soil consists of a dark-gray to nearly black light loam to heavy sandy loam carrying considerable amounts of coarse sand and fine gravel. The subsoil proper, which is encountered at an average depth of about 10 inches, consists of a yellowish sandy loam to loam containing small gravel. The content of gravel usually increases with depth, and occasionally the type is underlain by a gravel stratum. The topography is

broken to hilly, embracing morainic knolls and hills. This soil is derived directly from glacial till. The drainage is good except in some of the lower depressions. Bowlders of granite, gneiss, schist, and limestone are frequently encountered. Fruit and a number of vegetables give very fair results. Wheat, oats, and flax are grown, but the average yields are only moderately good.

STONY SANDY LOAMS.

TABLE XLII.—*Area and distribution of the stony sandy loams.*

Name of soil.	State and area.[1]	Acres.
Gloucester stony sandy loam	N. H. 1, 2	87,616
Adirondack stony sandy loam	N. Y. 13, 14; Vt. 1	59,456
Portage stony sandy loam	Wis. 3	11,392
Dover stony sandy loam	N. Y. 14	5,056

[1] For key to numbers in this column, see p. 253.

Gloucester stony sandy loam.—The soil consists of 8 inches of medium to fine sandy loam of light to dark-brown color; the subsoil, to an average depth of 18 inches, is a medium to fine yellow sand or sometimes light sandy loam. Small flakes of mica are generally present in both soil and subsoil. Scattered over the surface and in the soil and subsoil and becoming more abundant at a depth of 20 inches are glacial bowlders of all sizes, mostly angular and subangular in form. There is also more or less gravelly material upon the surface and throughout the profile. The type occupies the tops and slopes of hills. It is best used for pasturage. Apples do well in favorable situations.

Adirondack stony sandy loam.—The soil consists of about 5 inches of brown to yellow fine sandy loam. The subsoil is a fine sandy loam lighter in color. The whole section is more or less filled with angular fragments of granite, gneiss, and sandstone, with a few foreign glacial bowlders. The type is derived from the glaciation of the Adirondack mountain masses and occurs as morainic, colluvial, and local wash material from higher-lying positions. The topography is hilly to mountainous. This soil is light and loose and often droughty. It is adapted to corn and potatoes, though its best use is for forestry.

Portage stony sandy loam.—The soil is a rather loose dark-gray or brown sandy loam of medium to fine texture and from 8 to 10 inches deep. The underlying material is a yellowish-brown or gray sand of fine texture and from 8 to 10 inches deep. The underlying material is a yellowish-brown or gray sand of fine to medium texture to a depth of 30 inches, where a yellow or gray sandy clay sometimes

occurs. On the surface considerable quantities of bowlders, principally of granite, are found, and outcrops of the underlying crystalline rocks, from which the type is in part derived, frequently occur. The drainage is rather poor and the type is used only for pasturage.

Dover stony sandy loam.—The type consists of 8 to 10 inches of brown sandy loam, overlying a subsoil of light-brown to yellow sandy loam. Both soil and subsoil are loose, open, droughty. This is a warm soil, adapted to truck crops, especially such crops as cantaloupes, cucumbers, and small fruits like strawberries, raspberries, and blackberries.

GRAVELLY LOAMS.

TABLE XLIII.—*Area and distribution of the gravelly loams.*

Name of soil.	State and area.[1]	Acres.
Carrington gravelly loam	Kan. 2; Minn. 4; N. D. 2, 8	28,928
Volusia gravelly loam	N. Y. 5, 12	13,760
Caribou gravelly loam	Me. 1	3,904
Mapleton gravelly loam	Me. 1	192
Miami gravelly loam	Ohio 2	192

[1] For key to numbers in this column, see p. 253.

Carrington gravelly loam.—The soil consists of a dark-brown light sandy loam to heavy sandy loam carrying a considerable amount of small gravel. The subsoil is a quite gravelly sandy loam to clay loam of yellowish color. Occurring in the vicinity of streams where erosion has been quite active, there are a number of variations in the character of the material. Gravelly clay areas which give considerable trouble to cultivation are occasionally encountered. The topography is rolling to hilly and in the main badly dissected. The soil is derived from glacial till. Some areas have a sufficiently favorable surface configuration to admit of agriculture, but much of the type is too rough for cultivation and should be devoted to pasturage or timber lots. Corn and wheat do well on the gently rolling areas.

Volusia gravelly loam.—The soil, which has an average depth of 6 inches, consists of a light-brown to ash-colored loam containing a large quantity of broken shale and sandstone fragments and a considerable proportion of small shale chips, besides some rounded gravel and cobblestones. The subsoil varies from a yellow loam to a yellow or gray sandy loam. The type is derived from small moraines scattered throughout the Volusia loam or Volusia silt loam areas and occurs in the high valleys of the Volusia region.

Caribou gravelly loam.—The soil consists of a gravelly loam containing a high percentage of silt and varying in color from yellowish brown to dark-chocolate brown. At a depth of 10 inches the soil

grades into a bright-yellow gravelly loam with a higher content of gravel which, at about 20 inches, passes into a dark-colored coarse gravel or compact yellowish-gray gravelly loam. Both soil and subsoil carry from 40 to 50 per cent of rounded and angular glacial gravel from about one-fourth inch to 4 inches in diameter. The type occurs on knolls and along stream slopes. It may be used for potatoes and buckwheat. Oats and grass do fairly well.

Mapleton gravelly loam.—The soil is a purplish-red rather coarse gravelly loam 12 inches or less in depth. Usually the conglomerate bed rock is encountered at from 6 to 20 inches, and sometimes it outcrops in small areas. Where the depth is greater than 12 inches a reddish-yellow gravelly loam is found below this depth. The gravelly material consists of angular and waterworn fragments of sandstone and quartz. The type occupies ridges and slopes. Potatoes, grass, and grain may be produced to some extent where the rock does not come too near the surface. Apples do fairly well.

Miami gravelly loam.—The soil to a depth of 6 to 8 inches is a brown silty loam which carries on the surface and throughout the soil a small amount of gravel. The subsoil is a light-brown to brown clay loam containing more gravel than the surface soil. At about 2 to 3 feet gravel beds are often encountered. The type usually occupies the crests of ridges in the uplands. It is residual from glacial till. General farm crops are grown, but the yields are rather low, especially in dry years.

STONY LOAMS.

TABLE XLIV.—*Area and distribution of the stony loams.*

Name of soil.	State and area.[1]	Acres.
Holyoke stony loam	Conn. 1; Mass. 1	196,818
Dutchess stony loam	N. Y. 4, 14	127,232
Gloucester stony loam	N. H. 1, 2; N. Y. 4	115,200
Cossayuna stony loam	N. Y. 14	88,448
Carrington stony loam	N. D. 2, 5, 8; S. D. 2	84,096
Williams stony loam	N. D. 10	69,888
Bangor stony loam	Me. 2	29,248
Volusia stony loam	N. Y. 12	12,352
Hollis stony loam	N. H. 1	7,040
Caribou stony loam	Me. 1	3,328
Nunda stony loam	N. Y. 5	320

[1] For key to numbers in this column, see p. 253.

Holyoke stony loam.—The soil consists of about 3 feet of loam, containing from 10 to 50 per cent of diabase and other bowlders. The areas occupied are rough and mountainous, occurring along the lower slopes of diabase ranges. The soil is chiefly devoted to pasture, though it is used also to some extent for fruit.

Dutchess stony loam.—The soil consists of about 9 inches of light-brown, friable, and somewhat granular loam or silt loam. This is underlain to about 18 inches by a yellowish or reddish-yellow material, usually similar in texture to the soil, but sometimes slightly more sandy and sometimes decidedly more clayey. The type occupies low hills and ridges and rocky, irregular knolls, with small intervening swampy depressions. The underlying rock is often exposed. The drainage is generally good. Areas of this soil are mostly forested with oak, chestnut, maple, and cedar and not generally desired for farming land, but in places it gives excellent results with apples. It also makes valuable pasture land. Where used, organic matter should be supplied. For the most part it should be left in forest.

Gloucester stony loam.—The type consists of a light-brown sandy loam, underlain at about 10 inches by a more sandy and gravelly material of gray color. The subsoil is a mass of rock fragments or the thin soil may rest directly upon bed rock. From 20 to 80 per cent of bowlders occur on the surface and throughout the soil profile, while frequently the bed rock is exposed. The type usually presents a rough, broken topography, hilly and almost mountainous in character, and on account of its position and the loose, open character of the subsoil it is excessively drained. Very little of it is cleared and under cultivation, and it is covered for the most part with a stunted growth of chestnut, oak, white birch, and miscellaneous undergrowth. Some corn and potatoes are produced, but only light yields are obtained. The type as a whole is best suited to forestry and pasture, though in some places orcharding may be profitable.

Cossayuna stony loam.—This type consists of a brown or snuff-colored loam, 8 to 10 inches in depth, resting upon a subsoil of the same material, though of a lighter brown color. The subsoil usually extends to depths greater than 3 feet, though often the bed rock occurs near the surface. Both soil and subsoil contain considerable quantities of small shale fragments and small and large weathered fragments of calcareous sandstone and some foreign glacial bowlders. The weathering of this calcareous sandstone material gives to the type its dominating characteristics—the peculiar brown color and stone content. It occurs on rolling to hilly uplands. This type is well adapted to corn, oats, potatoes, hay, and apples and other tree fruits.

Carrington stony loam.—The soil consists of a dark-brown to black heavy sandy loam having a depth of 8 to 10 inches. The subsoil is a light-brown or yellow sandy loam to clay loam. A considerable amount of gravel is disseminated throughout the soil mass. Bowlders are thickly strewn over the surface and are of common occurrence throughout the soil. The type occupies rolling uplands and broken slopes. The soil material represents residual products

derived from glacial till. On account of the abundance of stones, cultivation is difficult over most of the type. Grass does well, and on the whole this soil is best adapted to pasturage.

Williams stony loam.—The type consists of a brown or dark-brown loam, usually underlain by a lighter colored (gray or yellowish gray) subsoil of slightly heavier texture than the soil. The quantity of stone ranges from 15 to 50 per cent of the whole mass to a depth of 3 feet and is often sufficient to prevent cultivation. The fragments vary in size from gravel to bowlders weighing many hundred pounds, but the larger bowlders are rare. The type occurs as upland areas in the semiarid region and has a roughly rolling topography. It is considered good grazing land.

Bangor stony loam.—The type consists of a grayish or yellowish-brown loam to sandy loam, 6 to 8 inches deep, overlying a somewhat lighter colored and more compact subsoil of about the same texture. The soil section varies, the bed rock lying from one to several feet below the surface and numerous small areas outcropping. The surface is so covered and the soil so filled with stone fragments as to preclude the possibility of profitable cultivation except of small patches. The topography is broken to hilly. The type is devoted almost exclusively to pasture and has a low agricultural value. A considerable portion is still forested.

Volusia stony loam.—The soil is a dark-brown rather heavy loam with an average depth of 9 inches. The subsoil, to a depth of about 3 feet, consists of a yellow or mottled yellow and gray loam which becomes more sandier with increasing depth. Both soil and subsoil are filled with flat shale and sandstone fragments. The type is derived from wash of higher-lying areas of Volusia loam or Volusia silt loam carried down and deposited over moraine belts bordering the higher uplands. Where the stone content is not too high the type is a good general-purpose farming soil, and where well drained is adapted to apples.

Hollis stony loam.—The soil, to a depth of 6 or 8 inches, is a light-brown fine loam. The subsoil is a light-yellow or grayish heavy loam to sandy loam. Both soil and subsoil are filled with slaty fragments of schistose rock, and occasionally there is considerable mica in both surface and subsoil. The surface consists of low knolls and ridges, with elevations ranging from 200 to 500 feet. The type is in part derived from overlying glacial material and in part from underlying micaceous schistose rock. Fair yields of corn, oats, and grass are secured. Apples are the principal fruit crop. Strawberries and other small fruits do well. There are some successful peach orchards on the type. The principal farming industry is dairying.

Caribou stony loam.—To a depth of 8 inches this type consists of a yellowish-brown silty loam. Underlying this is found a yellowish-gray silty loam which persists to the underlying rock. There are occasional small outcroppings of conglomerate, diabase, andesite, and quartz trachyte, and the slopes are strewn with glacial bowlders of similar rocks. On account of the presence of bowlders, the shallowness of the soil, and steepness of surface, the type is difficult to cultivate. It occupies high ridges, peaks, and steep slopes. The characteristic growth consists of yellow birch, beech, and maple, with a sprinkling of spruce and fir. None of the type is under cultivation. It is best suited for forestry.

Nunda stony loam.—The soil consists of about 6 inches of brown heavy loam filled to a considerable extent with rounded glacial stones and gravel. The subsoil is a bluish glacial till also filled with rounded limestone fragments and other glacial materials. The type is of local origin and small extent and not of value for agriculture.

SLATE LOAM.

TABLE XLV.—*Area and distribution of the slate loam.*

Name of soil.	State and area.[1]	Acres.
Dutchess slate loam	N. Y. 4, 14	138,624

[1] For key to numbers in this column, see p. 253.

Dutchess slate loam.—The soil to 6 or 8 inches is a light-brown fine silty, though often gritty, shale or slate loam. The surface soil is underlain by a lighter colored or yellowish material, usually of the same texture as the soil to about 24 inches. Rock fragments and rock outcrops are common. Areas of this soil occur on hills and ridges of varying heights with intervening swampy depressions. The surface drainage is usually free and the land is likely to be droughty. A large percentage of this type is still forested with chestnut, oak, and cedar. It is considered a light, thin land, and requires constant fertilization, but is fair for grass, pasture, and buckwheat. All general farm crops are grown to some extent.

MISCELLANEOUS MATERIALS.

Under this head are grouped nonagricultural materials or material like Muck, which lends itself to no mineral classification and requires extensive and expensive reclamation to adapt it to agricultural use.

TABLE XLVI.—*Area and distribution of the miscellaneous materials.*

Kind of material.	State and area.[1]	Acres.
Rough stony land	Ill. 3, 4, 7; Ind. 3; Ia. 2; Kans. 2; Me. 2; Mich. 4; Minn. 2, 6; Mo. 7; N. H. 1, 2; N. Y. 4, 9, 10, 12, 14; R. I. 1.	951,232
Rock outcrop	Minn. 2, 6; N. H. 2; N. Y. 4, 13, 14; Vt. 1; Wis. 5	132,224
Muck	Ind. 1; Me. 2; N. Y. 9	48,448
Peat	Me. 2; Minn. 5	28,736
Dunesand	N. D. 9	19,008
Rough broken land	N. D. 2, 5	6,208
Madeland	N. Y. 4, 11	1,024

[1] For key to numbers in this column, see p. 253.

Rough stony land.—Under this heading have been classed areas so stony and broken as to be nonarable, although permitting timber growth and use for pasturage. These areas frequently consist of steep mountain ridges, bluffs, or narrow strips extending through definite soil types. They differ from rock outcrop in that they support vegetation of some economic value and from the stony loams in being nonarable.

Rock outcrop.—This term is used to designate areas consisting of rock ridges, exposed rock outcrops, or accumulations of stone entirely unfit for cultivation and incapable of becoming agricultural land.

Muck.—This type consists of black, more or less thoroughly decomposed vegetable mold from 1 to 3 feet or more in depth and occupying low, damp places, with little or no natural drainage. Muck may be considered an advanced stage of Peat, brought about by the more complete decomposition of the vegetable fiber and the addition of mineral matter through deposition from water or from æolian sources, resulting in a finer texture and closer structure. When drained, Muck is very productive and should be used for cabbage, onions, celery, peppermint, and similar crops.

Peat.—This is vegetable matter, consisting of roots and fibers, moss, etc., in various stages of decomposition, occurring as turf bog, and representing an advanced stage of swamp, with drainage partially established. It is of less value when reclaimed than is muck.

Dunesand.—This consists of loose, incoherent sand, forming hillocks, rounded hills, or ridges of various heights. The dunes are found along the shores of lakes, rivers, or oceans and in desert areas. They are usually of no agricultural value on account of their irregular surface, the loose, open nature of the material, and its consequent low water-holding capacity. The dunes are frequently unstable and drifting. The control of these sands by the use of windbreaks and binding glasses is frequently necessary for the protection of adjoining agricultural lands.

Rough broken land.—Owing to the broken character of the surface and the location on the steep sides of bluffs it has little value except as a sheep or cattle pasture.

Madeland.—Areas are occasionally encountered where filling has taken place over considerable tracts. The arrangement of the materials in these places is artificial and does not fit into any soil classification. In many instances such areas are extensive, although they are usually of no present agricultural value.

SUMMARY.

It is estimated that there are 455,000,000 acres in the Glacial and Loessial province, of which, so far as the survey has been extended, approximately 16.6 per cent, or one-sixth, is a single-soil type (Marshall silt loam); 45.8 per cent is covered by the single group of silt loam soils; and over 73 per cent has a narrow range in texture (loam, silt loam, and clay loam), with relatively few types in each grade.

The material composing these soils is very heterogeneous, being made up of many kinds of rocks, but the process of formation has been uniformly the same, the grinding of the rocks by glaciers and subsequent weathering, which has given in the main a rather uniform grade of soil.

This comparative uniformity or narrow range in soil texture, especially centering around the silt loams, makes for a rather uniform type of heavy general farming and less opportunity for diversification and specialization than is presented in the Glacial Lake and River Terrace province, and still less than in the Coastal Plains province, with its wide variation in climate and continuous advance of season from Florida to New York.

The soil survey has completed the mapping of 24,562,696 acres in the Glacial and Loessial province. This is about 5.4 per cent of the total estimated area of the province.

The province for the most part is the most northern of the soil provinces, where the spring is late and the seasons are short, but where the hours of sunshine throughout the growing season are considerably greater, thus shortening the necessary period of growth by many days. About 74 per cent of the soil area so far mapped is composed of loams, silt loams, and clay loams—heavy soils, requiring heavy farm equipment of teams, implements, and buildings, and best used for heavy farm crops and an intensive type of dairying. Furthermore, for the four months from July to October, inclusive, the main supply of fresh vegetables and fruits for the great northern markets must be drawn from these soils, and a large supply of vegetables for canning and the main supply of vegetables and fruits of suitable quality for storage for winter use.

The sands, fine sand, sandy loams, and fine sandy loams, constituting in the aggregate about 12.5 per cent of the area, poorly adapted to the dominant type of agriculture, have never, except recently and locally, been appreciated at their full value for the production of midsummer vegetables and fruits with light farm equipment but with intensive methods.

The sands, covering 1,390,536 acres surveyed, or 5.6 per cent of the area surveyed, are adapted to the earliest truck and fruit crops, which begin to come on the market early in July, when the supply of similar crops from the Atlantic and Gulf Coastal Plains province is about exhausted.

The fine sand, covering 168,140 acres, or 0.7 per cent of the area surveyed, matures its crops on the average about two weeks later, with somewhat larger yields and better quality.

The fine sandy loams, covering 251,584 acres, or 1.4 per cent of the area, are a little better adapted to general farming, but still require rather light farm equipment.

The sandy loams, covering 1,277,236 acres, or 5.2 per cent of the area, give still later crops and larger yields, and here the lightest type of general farming really comes in.

The loams, covering 4,363,284 acres, or 17.7 per cent of the area, bring a crop of vegetables and fruits largely used for canning purposes, and require a medium heavy farm equipment for general farm crops.

The silt loams, covering 11,274,496 acres, or 45.8 per cent of the area, three times as large as any other group of soils, requires the heaviest farm equipment for general farming, and produces the finest quality of vegetables and fruits for canning purposes and for storage for the winter supply.

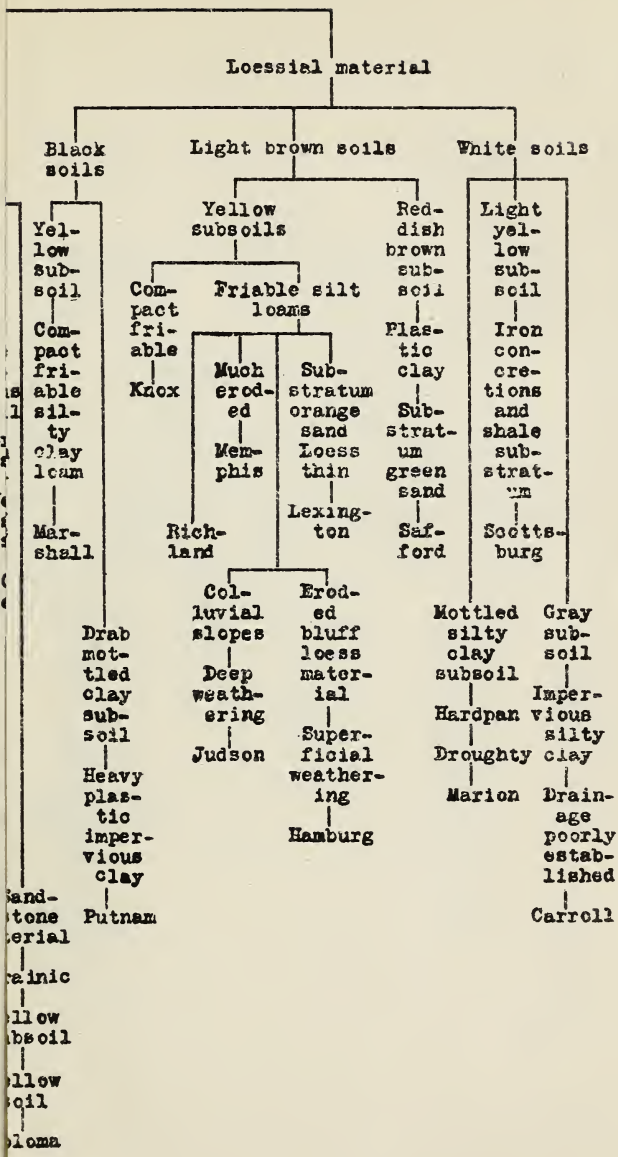
The clay loams, covering 3,406,234 acres, or 13.8 per cent of the area, require likewise the heaviest type of farm equipment, and provide for the most intensive system of dairying.

No true clay soil has been encountered in this province.

There are 2,431,186 acres of land in the area surveyed, or 9.9 per cent of the total area, which, with the exception of some 48,448 acres of Muck, in part reclaimed and nearly all reclaimable, is of such slight agricultural value at the present stage of agricultural development that it may be thrown out of agricultural use, except for pasture and forestry.

The classification of the soils of this province is shown in the diagram, figure 8, facing page 130.

Fig. 8.


Loessial material
Black soils
Light brown soils
White soils
Yellow subsoils
Reddish brown subsoil
Light yellow subsoil
Yellow subsoil
Compact friable silty clay loam
Marshall
Compact friable
Knox
Friable silt loams
Much eroded
Memphis
Richland
Substratum orange sand
Loess thin
Lexington
Plastic clay
Substratum green sand
Safford
Iron concretions and shale substratum
Scottsburg
Drab mottled clay subsoil
Heavy plastic impervious clay
Putnam
Colluvial slopes
Deep weathering
Judson
Eroded bluff loess material
Superficial weathering
Hamburg
Mottled silty clay subsoil
Hardpan
Droughty
Marion
Gray subsoil
Impervious silty clay
Drainage poorly established
Carroll

Key to the Soils of the Glacial and Loessial Province

- Thin glacial material
  - Mainly granitic or metamorphic material
    - Mainly granite with some schist and gneiss
      - Brown soil
        - Yellow subsoil
          - Gloucester
            - Gray soil
              - Mottled yellow and red subsoil
                - substratum residual
                  - Portage
    - Mainly slate and schist
      - Light brown soil
        - Yellow subsoil
          - Dutchess
    - Mainly schist with some granite and gneiss
      - Brown soils
        - Gray subsoil
          - Bangor
            - Hollis
        - Yellow subsoil
          - Substratum blue clay
            - Bernardston
    - Mainly diabase and granite
      - Brown soil
        - Yellow subsoil
          - Holyoke
  - Mainly limestone material
    - Pure limestone
      - Brown soils
        - Yellow subsoil
          - Dover
        - Gray or bluish subsoil abundant boulders
          - Morainic
            - Nunda
    - Shaley limestone
      - White soil
        - Mottled yellow subsoil
          - Drainage poorly established
            - Easton
        - Light brown soil
          - Yellow subsoil
            - Drainage well established
              - Caribou
  - Mainly shale with some sandstone
    - Calcareous
      - Black shale
        - Black soil
          - Mottled
            - Clay loam subsoil
              - Mohawk
        - Light colored shale
          - Brown soil
            - Light brown subsoil
              - Cossayuna
    - Noncalcareous
      - Light colored shale
        - Brown soil
          - Yellow subsoil
            - Volusia
  - Mainly sandstone with some shale
    - Red sandstone
      - Red soil
        - Yellow subsoil
          - Red conglomerate substratum
            - Mapleton
        - Indian red subsoil
          - Wethersfield
        - Light colored sandstone
          - Brown soil
            - Yellow subsoil
              - Adirondack
  - Mainly shale and limestone
    - Brown soils
      - Reddish clay loam subsoil
        - Deep drumlin phase
          - Ontario
        - Thin phase (rock substratum)
          - Cazenovia
- Deep glacial material
  - Assorted glacial material
    - Brown soil
      - Yellow subsoil
        - Terminal moraine
          - Plymouth
        - Outwash plains and filled in valleys
          - Carver
    - Outwash and filled in valleys
      - Yellow subsoil
        - Yellow soil
          - Plainfield
        - Black soil
          - Waukesha
  - Thin ice laid matsrial overlying modified drift
    - Brown soil
      - Yellow subsoil
        - Ground moraine
          - Flushing
  - Ice laid material
    - Substratum of boulder clay
      - Yellow subsoil heavy clay loam
        - Yellow soil
          - Miami
        - Black soil
          - Carrington
        - Yellow sandy clay subsoil
          - Brown soil
            - Steep slopes near streams
              - Shelby
      - White calcareous subsoil
        - Brown soil
          - Williams
      - Sandstone material
        - Morainic
          - Yellow subsoil
            - Yellow soil
              - Coloma
- Loessial material
  - Black soils
    - Yellow subsoil
      - Compact friable silty clay loam
        - Marshall
        - Drab mottled clay subsoil
          - Heavy plastic impervious clay
            - Putnam
  - Light brown soils
    - Yellow subsoils
      - Compact friable
        - Knox
      - Friable silt loams
        - Much eroded
          - Memphis
            - Richland
            - Colluvial slopes
              - Deep weathering
                - Judson
        - Substratum crangs sand Looss thin
          - Lexington
            - Eroded bluff loess material
              - Superficial wsathering
                - Hamburg
    - Reddish brown subsoil
      - Plastic clay
        - Substratum green sand
          - Safford
  - White soils
    - Light yellow subsoil
      - Iron concretions and shale substratum
        - Scottsburg
        - Mottled silty clay subsoil
          - Hardpan
            - Droughty
              - Marion
        - Gray subsoil
          - Impervious silty clay
            - Drainage poorly established
              - Carroll

SOILS OF THE GLACIAL LAKE AND RIVER TERRACE PROVINCE.

The Glacial Lake and River Terrace province is estimated to cover an area (41,000,000 acres) one-tenth as large as the Glacial and Loessial province. The soil material is derived from the latter province, but has been worked over and sorted out by lake and river action, which has separated it into different grades, so that we have in this smaller province a much greater number of soil types, a more uniform distribution in groups of soils, and a greater opportunity for specialization in crops, a fact which is just beginning to be realized. We have, in fact, three different types of farming establishing themselves to a greater extent and more successfully than in the Glacial and Loessial province, where the lighter soils are of subordinate extent and are always associated with the heavier type of agriculture of the dominant heavy soils.

There are two facts that must be borne in mind in comparing soils of this province with soils of similar texture in the Glacial and Loessial province; that the soils as such are younger and have frequently a lower topographic position with respect to the underground water table. The fact that they are younger means that they have not weathered so completely. With the one important exception they are likely to contain more organic matter and for this reason the light soils of similar groups are in general more loamy and less incoherent. This makes them group by group rather more productive and rather slower in maturing crops. When the water table is near the surface, as for example in the Clyde soils, they may be used for a heavier type of crops. Thus wheat and hay may be grown on the lighter members of the Clyde series, whereas they could not be recommended for soils of similar texture in the upland series.

The direction in which specialization should proceed will be seen from the descriptions of the several groups and soil types.

The relative extent of the different grades of soil is shown in figure 9.

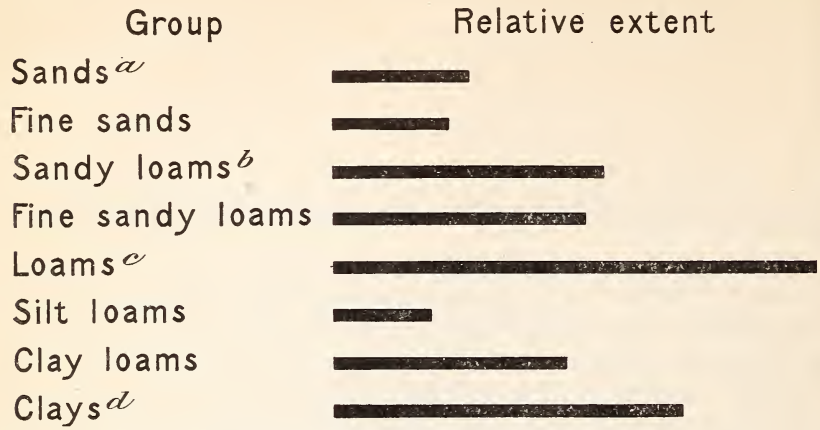


FIG. 9.—Diagram showing the relative extent of the important groups of soils in the Glacial Lake and River Terrace province. [a] Including the gravel, gravelly sand, and coarse sand phases. [b] Including the gravelly sandy loam, stony sandy loam, and coarse sandy loam phases. [c] Including the gravelly loam, stony loam, and shale loam phases. [d] Including the black clay, stony clay, and silty clay phases.

THE SAND GROUP.

Only a comparatively small part of the area of the Glacial Lake and River Terrace province is included in the sand group. The several soils and the extent of each are shown in Table XLVII.

TABLE XLVII.—*Area and distribution of the sands.*

Name of soil.	State and area.[1]	Acres.
Dunkirk sand	Minn. 3, N. D. 8, Ohio 8	74,688
Clyde sand	Mich. 1, 2, 3, 7, 8	67,400
Fargo sand	N. D. 3, 8	51,520
Merrimac sand	N. H. 1, 2	44,480
Saugatuck sand	Mich. 1	24,120
Sioux sand	Minn. 1, Wis. 6	23,552
Mankato sand	Mo. 11	448

[1] For key to numbers in this column, see p. 253.

Dunkirk sand.—The soil consists of yellowish loamy fine to medium sand. The type occurs as nearly flat to undulating areas, a portion of which requires artificial drainage in order to be put in condition for agricultural use. The soil consists of terrace or shore-line deposits, representing glacial material reworked by the waters of glacial lakes. Only moderate yields of grass, corn, wheat, and truck crops are secured. Potatoes, apples, plums, and strawberries seem to give particularly good results.

Clyde sand.—The type consists of 12 inches of black sand, underlain by a lighter-colored sand to a depth of 30 inches, which in turn is generally underlain by clay. The type occupies low, flat areas and is generally swampy and poorly drained. When well drained, the soil produces good crops of corn, wheat, grass, oats, rye, and the heavier truck crops, particularly cabbage, onions, and celery. When thoroughly drained it produces the earlier and lighter truck crops and becomes unsuited to general farm crops.

Fargo sand.—This type has a dark surface soil, with an average depth of about 14 inches and varying in texture from a loamy sand to a sandy loam, the sand particles being for the most part coarse. The subsoil is a yellow loamy sand or a coarse sandy loam, and occasionally clay is found at a depth of about 3 feet. There is no gravel in the soil, but a little fine gravel is sometimes found in the subsoil. The type has a very gently rolling to level topography. When thoroughly drained it is well adapted to truck, which, when markets for fresh vegetables are not available, can be grown for canning.

Merrimac sand.—The soil consists of a gray or light or dark brown medium-textured sand. The subsoil to depths greater than 36 inches is a yellowish sand of very much the same texture and composition as the surface material. There is usually a noticeably high proportion of fine sand in some areas occupying higher elevations, where more or less wind-blown material has accumulated, while in other areas the soil tends to the other extreme, approximating a coarse sand in texture and carrying some gravel. The type occurs along streams, ponds, and lakes. It is derived from reworked glacial drift, modified by wind action. The characteristic vegetation is white pine and coarse grasses. Little of the type is under cultivation. It should be used for the light truck crops for the earliest summer markets.

Saugatuck sand.—The soil consists of a reddish-brown, black, and gray sand 9 inches in depth. The subsoil, to a depth of 3 feet or more, is a medium fine sand, containing bands of sand cemented by ferruginous material. These bands of iron crust vary from a fraction of an inch to 1 foot or more in thickness. The type occupies slightly depressed areas. It should be used for truck, peaches, and small fruits.

Sioux sand.—The soil consists of from 5 to 20 inches of loose, medium to coarse textured, dark-colored sand. The subsoil, which extends to great depths, has about the same texture as the soil, but is of a light-yellowish color. The type forms flat valley lands lying only 5 or 10 feet above mean water level in the streams. It is naturally well drained and seldom subject to overflow. In narrow valleys where moisture conditions are favorable the type is cleared and cultivated. Broad areas often suffer from drought, and are left to

the native growth of scrubby pine and oak. The type is used for corn, of which 40 to 80 bushels per acre are obtained under good moisture conditions and with heavy fertilization. Vegetables, strawberries, and cranberries also do well on limited areas. The greater part of the type can be safely used for agriculture only and under irrigation.

Mankato sand.—The type consists of a medium to fine brown or nearly black, slightly loamy sand, resting at about 2 feet upon a yellowish medium to fine sand, which frequently becomes gravelly at a depth of about 3 feet. The topography is nearly level. The type should be used for early summer vegetables.

GRAVEL PHASE.

There are only two types of soil in the gravel phase. These occur principally in New York State.

TABLE XLVIII.—*Area and distribution of the gravels.*

Name of soil.	State and area.[1]	Acres.
Hoosic gravel	N. Y. 14	31,232
Dunkirk gravel	N. Y. 5, 15; Ohio 1	8,040

[1] For key to numbers in this column, see p. 253.

Hoosic gravel.—The soil consists of a mass of small to large gravel, with which there is commingled a varying but usually small percentage of fine-earth material. The surface few inches is brown in color, while the lower depths are either a light brown or yellow. The whole section is loose and open and drainage is somewhat excessive. The type is a stream deposit from swiftly moving water currents of large volume. It is adapted to corn, potatoes, rye, clover, and alfalfa, though the yields are sometimes curtailed by drought.

Dunkirk gravel.—This is a very gravelly soil of old lake beaches, occurring in narrow bands between the lake and uplands. The soil is composed of waterworn fragments of shale and is 6 feet or more deep. The soil is quite droughty and not well suited to any other crop than grapes. The grapes mature early and supply the early markets, but do not keep as well nor bear shipment as well as those grown on heavier soils.

GRAVELLY SAND PHASE.

TABLE XLIX.—*Area and distribution of the gravelly sands.*

Name of soil.	State and area.[1]	Acres.
Dunkirk gravelly sand	Mich. 5, 8; N. Y. 5	32,288
Clyde gravelly sand	Mich. 1, 8	24,656

[1] For key to numbers in this column, see p. 253.

Dunkirk gravelly sand.—The soil of this type is a yellowish-brown to brown gravelly sand about 8 inches in depth. The subsoil, to 36 inches, is a gravelly sand, somewhat lighter in color than the underlying beds of stratified sand and gravel. The sand content of both soil and subsoil is largely coarse, medium, and fine sand. The gravel content is usually high, being about 50 per cent in typical areas, though small areas occur within the type in which there is little or no gravel. The type is best adapted to such crops as cantaloupes, cucumbers, and other truck crops and for those crops which must be forced to early maturity. It is too light and loose for general farm crops unless heavily manured.

Clyde gravelly sand.—The soil is a medium-textured, light to dark-brown loamy sand or light sandy loam 10 inches deep, carrying a large percentage of gravel. The subsoil is a rather coarse incoherent gravelly sand, usually grading into a mixture of coarse sand and fine gravel at a depth of from 24 to 30 inches. Clay is often found at from 4 to 8 feet below the surface. The type is generally well drained. The topography varies from gentle slopes to gently rolling ridges, representing old beach lines or terraces. Fairly good yields of corn, oats, wheat, rye, timothy, clover, and buckwheat are secured, and some special crops, such as sugar beets and beans, give good results. The soil should be used for very early fruit and truck crops. It may also be used for early crops of potatoes.

COARSE SAND PHASE.

The coarse sand phase of this group consists of three types, confined to New England and New York, so far as this is indicated by the surveys completed up to January 1, 1910. The following table shows the distribution of these types:

TABLE L.—*Area and distribution of the coarse sand.*

Name of soil.	State and area.[1]	Acres.
Merrimac coarse sand	Conn. 1; Mass. 1; N. H. 1, 2	110,408
Hoosic coarse sand	N. Y. 14	6,080
Dunkirk coarse sand	N. Y. 9	3,200

[1] For key to numbers in this column, see p. 253.

Merrimac coarse sand.—The soil has an average depth of about 8 inches, and consists of a yellowish coarse sand to dark-brown coarse loamy sand. The subsoil consists of a yellow coarse sand, usually resting at an average depth of 20 inches on a stratum of white waterworn quartz gravel. This gravel sometimes comes within a few inches of the surface, and again is not found within

the 36 inches of the profile. Both soil and subsoil are composed largely of coarse and medium sands, with very little of the finer grades, but both often contain a high percentage of gravel. The type occupies areas along stream courses and has a level topography. This is the lightest soil desirable for light truck crops for the early summer markets. For this use it must be under a high state of cultivation and be liberally manured.

Hoosic coarse sand.—The soil consists of from 4 to 6 inches of coarse sand, light brown in color. The subsoil is of about the same texture, is light brown to yellow in color, and extends to a depth of several feet. Some small gravel is frequently encountered upon the surface and throughout both soil and subsoil. The surface is level to gently undulating and the drainage is inclined to be excessive. It is a delta formation, formed under glacial lake conditions. It is little used for agriculture except for kitchen gardens, but where a sufficient moisture content can be maintained it is adapted to the production of early truck crops, strawberries, and early vine crops.

Dunkirk coarse sand.—The type consists of 3 feet or more of a loose, friable sand of yellowish or brownish color. At depths rangings from 5 to 10 feet or more the sand is underlain by a chocolate-colored clay. The surface is usually level but the drainage is excellent. The type is highly prized for trucking where markets are available, but it is generally considered too droughty for general farming. This soil should be used, when the markets and transportation facilities are available, for the very earliest of the summer vegetables raised under intensive culture.

THE FINE SAND GROUP.

The soils of the fine sand group are as a rule adapted to vegetables and small fruits for the medium late summer market.

TABLE LI.—*Area and distribution of the fine sands.*

Name of soil.	State and area.[1]	Acres.
Fargo fine sand	N. D. 8, 9	164,160
Dunkirk fine sand	Ind. 1, 7; Mich. 5, 8; N. Y. 1, 5, 7, 8, 10, 11.	126,784
Clyde fine sand	Ind. 7; N. Y. 5, 8	62,016
Manchester fine sand	Conn. 1; Mass. 1	46,462
Vergennes fine sand	N. Y. 13; Vt. 1	8,384
Hoosic fine sand	N. Y. 14	7,168
Newton fine sand	Ind. 7	5,888
Orono fine sand	Me. 2	3,264
Caneadea fine sand	N. Y. 5	1,024

[1] For key to numbers in this column, see p. 253.

Fargo fine sand.—The type consists of dark-brown loamy fine sand having an average depth of about 16 inches, beneath which is found a yellow loamy fine sand. There are no stones or gravel in either soil or subsoil. There are, however, occasional wet and sloughlike places of small extent, where the soil is considerably heavier than the average. The type occupies level to gently rolling areas. A very large proportion of it is yet unbroken and utilized chiefly for the production of wild hay. When well drained it should be used for potatoes, small fruits, and vegetables for the medium late summer markets, or when markets for fresh vegetables are not available, for canning crops.

Dunkirk fine sand.—The soil is a brown to gray or yellow fine to medium sand, varying in depth from a few inches to 1 foot. It is usually quite uniform in texture and contains few stones and gravel. The subsoil is an orange, gray or yellow to brown loose, incoherent sand, resembling the soil in texture. The type occupies lake-plain lowlands and varies in topography from nearly level to rolling. A small proportion of the area occurs as ridges or knolls. It sometimes represents ancient beaches and again lake sediments redistributed by wind action. The soil is well adapted to early truck crops, including especially melons, tomatoes, and cucumbers. Small fruits also do well.

Clyde fine sand.—The soil consists of a dark-gray to black fine sand varying in depth from 4 to 20 inches. The subsoil has about the same texture as the soil, but contains less organic matter and is lighter in color. The surface is nearly level and the natural drainage is generally poor, conditions being greatly improved by artificial drainage. The present crop value of this soil depends upon the proportion of organic matter it contains and upon the drainage conditions. Where in proper physical condition naturally, or where artificially drained, it should be used for vegetables for the late summer markets and for small fruits. It is an ideal soil for strawberries.

Manchester fine sand.—The soil is a dark fine sand about 8 inches deep, underlain at about 20 inches by medium sand resting on glacial till, which is generally derived from red Triassic sandstone. The surface is slightly rolling and has been to a slight extent modified by wind action. Where the subsoil is not too deep the type is retentive of moisture, and fair crops of truck, the grains, and tobacco are produced.

Vergennes fine sand.—The soil consists of a dark-brown, black, or yellow loamy fine sand, from 6 to 10 inches deep. The subsoil is a light-brown or yellow medium sand resting upon the basal clays of the region at depths ranging from 3 to 4 feet, though in rare instances the sandy material may be 6 feet or more in depth. Small quantities of gravel are frequently found in both soil and subsoil. This type of

soil is quite varied in surface features, occurring in level areas, along slopes, and among foothills, and for the most part is well drained. When the topography is favorable the soil should be used for truck crops for the late summer markets and for small fruits; otherwise corn, oats, and grass are the best crop, of which small yields may be expected.

Hoosic fine sand.—The soil consists of a light-brown fine sand with an average depth of 7 inches, underlain by a subsoil, 3 feet and more in depth, of very light brown to yellow fine sand. In origin this type is alluvial, the areas representing delta or high terrace forms of former flood deposits. It is adapted to early truck crops, corn, rye, potatoes, and clover.

Newton fine sand.—The type consists of a light-gray to yellowish fine sand, which is underlain at depths varying from 10 to 36 inches by interstratified layers of peat and black fine sand. The surface is generally level, although somewhat broken by ponds and swampy depressions. The type has probably been formed by the deposition of a layer of light-colored fine sand over the black fine sand, which when not so covered gives rise to the Clyde fine sand. Much of the type supports a growth of water-loving grasses, willow, and birch, and its chief use is for pasture. It seems to be the result of purely local conditions and hardly worth reclaiming at the present time.

Orono fine sand.—The soil is a loose incoherent fine sand several feet deep. The first 7 to 10 inches is very light brown in color, and the subsoil a pale yellowish brown, becoming more gray with depth. The porous subsoil favors excessive subdrainage. The surface is rolling to sharply undulating. The type is adapted, under intensive culture, to vegetables for the early or midsummer markets, as well as to small fruits.

Caneadea fine sand.—The soil, to a depth of about 10 inches, is a fine to very fine sand of yellow color. The subsoil is almost identical with the surface soil in texture and color. The type is not largely cultivated, though well suited to early summer truck crops, if care be taken to increase and maintain the organic matter content under intensive culture.

THE SANDY LOAM GROUP.

The sandy loams of this province are a group of general-purpose soils suited for production of vegetables and small fruit, of which they give large yields for the late summer markets, and especially for canning. They also constitute the lightest group of soils desirable for general farm crops.

TABLE LII.—*Area and distribution of the sandy loams.*

Name of soil.	State and area.[1]	Acres.
Sioux sandy loam	Ill. 11; Ind. 3, 5, 10; Iowa 1; Minn. 5; Mo. 7; Nebr. 1; S. Dak. 2; Wis. 2, 4, 6.	210,112
Clyde sandy loam	Ind. 3; Mich. 2, 5, 8	124,288
Hartford sandy loam	Conn. 1; Mass. 1	95,304
Dunkirk sandy loam	Ind. 1; Mich. 9; N. Y. 9, 10; Ohio 8, 10	65,280
Fargo sandy loam	N. Dak. 9	53,504
Manchester sandy loam	Conn. 1; Mass. 1	44,160
Superior sandy loam	Wis. 5, 7	22,144
Williston sandy loam	N. Dak. 10	3,584
Walcott sandy loam	N. Dak. 9	3,264
Mankato sandy loam	Minn. 1	2,816
Vergennes sandy loam	N. Y. 13; Vt. 1	2,112
Hudson sandy loam	N. Y. 4	1,856
Tuscarora sandy loam	N. Y. 5	320

[1] For key to numbers in this column, see p. 253.

Sioux sandy loam.—The soil is a brown coarse to medium sandy loam or heavy sandy loam, from 10 to 24 inches deep, containing considerable organic matter. The color becomes lighter with depth. The subsoil over wide areas consists of almost pure waterworn gravel, which is found at an average depth of 22 inches below the surface and extends to great depths. The subsoil, however, varies considerably, and the gravel is frequently bedded in a matrix of sandy loam, silty sand, or sand. The soil occupies river terraces or bottoms, with level to gently rolling topography. The drainage is too thorough where the pure gravel subsoil predominates for good yields, although the soil is early and might be profitably utilized in the production of early, short-seasoned crops. Hay, corn, oats, and alfalfa are important crops, but the yields are very uncertain, depending as they do upon the amount and distribution of the rainfall.

Clyde sandy loam.—The type consists of a dark-gray or brown medium-textured sandy loam, from 8 to 12 inches deep, resting on material of similar texture, but lighter color, which is underlain at 18 inches by a drab or brownish mottled sandy clay, sometimes tending toward a sticky sandy loam. The soil carries a rather high percentage of organic matter and is easily brought into good tilth. The surface is level to gently rolling, and upon the whole the drainage is fairly good. This is a good soil for general farm crops, sugar beets, beans, potatoes, and orchard fruit. It may be used with excellent results for a light type of general farming in which sugar beets have an important place, for beans, potatoes for the fall and early winter, for the heavier truck crops, and for canning crops.

Hartford sandy loam.—The soil, which has an average depth of about 12 inches, varies from a loose porous brownish sandy loam to a more compact dark-brown sandy loam. The loose porous material

occurs as gently rolling sand dunes and is underlain by material of the same texture, but of lighter color, to a depth of 20 or 30 feet. The compact dark-brown material has a leveler surface and is underlain to 3 feet or more by a red or yellow sand or sandy loam. The type occurs as terraces along the Connecticut River, but is not subject to overflow. It has good drainage and is extensively used for truck crops and for a light type of general farming. It is recognized as the best soil in the Connecticut Valley for cigar-wrapper tobacco.

Dunkirk sandy loam.—The type consists of a brown sandy loam about 10 inches deep, underlain to a depth of 36 inches or more by lighter colored sandy loam, sometimes containing fine gravel. The topography is undulating to gently rolling, and the drainage is always free and sometimes excessive. The type is derived from glacial material reworked by streams and waves. It is not an especially good soil for general agriculture, but is very well adapted to truck and garden crops, especially cabbage, tomatoes, cucumbers, and potatoes.

Fargo sandy loam.—The soil to about 18 inches is a dark-brown fine sandy loam. This is underlain to 24 inches by a yellowish fine sandy loam, from which point to 36 inches is found a grayish-yellow silt loam. Gravel is often present in both soil and subsoil. The surface features vary from undulating to broken and the natural drainage is usually good. The soil is adapted to all of the general farm crops of the region, under a light system of farming, with moderate yields of wheat, oats, and flax.

Manchester sandy loam.—The type consists of a reddish or dark-yellow medium sandy or gravelly loam from 8 to 18 inches in depth, underlain by loamy sand and gravel, frequently containing large bowlders. The surface is generally rolling, being marked by ridges and knolls, though the type occasionally occurs as low, flat terraces. It is formed in part of material derived from the red Triassic rocks. It is naturally fertile, but the porous subsoil renders it readily subject to drought. It is well adapted to peaches and fairly well to corn.

Superior sandy loam.—The soil consists of a gray to reddish sand or light sandy loam, of medium texture, varying in depth from 12 to 24 inches. Sometimes the surface is strewn with small rocks and bowlders in such quantities as to interfere with cultivation. The subsoil is a stiff, tenacious, impervious red clay, similar to the material forming the Superior clay, and it is sometimes interstratified with thin layers of fine sand. The type usually occupies level and gently rolling areas, with sufficient elevation to secure good natural drainage. It is a warm soil, easily tilled, and adapted to a variety of crops, particularly to clover, timothy, potatoes, and small fruits,

and should be used for vegetables for the midsummer and fall markets, where market facilities warrant.

Williston sandy loam.—The type consists of a dark-brown medium to fine sandy loam, underlain at an average depth of 2 feet by a whitish loam or sandy loam. It occupies high-lying stream terraces. In seasons of average rainfall good crops of wheat and flax are secured. Its remoteness from large markets, together with the uncertainties of the rainfall, restricts its use to a few crops.

Walcott sandy loam.—The soil ranges from a grayish to brownish sandy loam, with an average depth of 8 or 10 inches, while the subsoil to a depth of 3 feet or more varies from a sand to a sandy clay of yellowish color. Sometimes small sand dunes from 1 to 2 feet high occur, and in such cases the type is sandier. Aside from the low sand dunes the surface is level, and there are considerable areas which are poorly drained and uncultivated. The type is derived largely from light sandy material blown from the adjacent areas of Fargo fine sand and spread out over the heavier lacustrine materials. It is of small extent and so situated as hardly to justify reclamation at the present time. In its present condition its best use is for wild prairie hay and pasturage.

Mankato sandy loam.—The type consists of a brown to dark-brown medium fine sandy loam, underlain at an average depth of 15 inches by bed rock. Usually 2 or 3 inches of the material directly overlying the rock has a reddish-brown color and fine loamy texture. In some places the soil is 2 feet deep, in others only a few inches of fine material cover the rock, and in still other the rock outcrops. Generally the shallower the soil, the more loamy the texture. Granitic bowlders from 1 foot to 6 feet or more in diameter are scattered quite thickly over the surface in some localities, but as a rule they are not numerous enough to interfere seriously with cultivation. The type occurs in the form of river terraces. It is droughty. Light to fair yields of corn are secured. In wet and moderately wet seasons excellent pasturage is afforded. Where the sand is deepest the areas are well adapted to the production of early summer vegetables.

Vergennes sandy loam.—The soil is a black or dark-brown medium to fine sandy loam from 8 to 12 inches deep. The soil does not differ materially in texture from that of the Vergennes fine sand, but the subsoil is a drab clay loam or clay. In a few places the typical soil is underlain at an average depth of 12 inches by a layer of medium textured sand, which rests directly upon the heavy underlying clay. In surface features the type is either level or rolling, marked sometimes by hummocks and low swells. This for the most part is well drained. This soil should be used for corn, clover, and truck crops for the late summer and fall markets.

Hudson sandy loam.—The type consists of 8 inches of light-brown medium sandy loam, underlain by a medium textured somewhat incoherent yellow sandy loam, which occasionally contains an admixture of gravel. The subsoil is underlain by clay deposits. The surface varies from nearly level to rolling and has good drainage. Little of this soil type is in cultivation, though it is a fair soil for all general farm crops and is particularly well adapted to trucking and small fruit.

Tuscarora sandy loam.—The soil is a mellow sandy loam, about 8 inches in depth, and having a gray to brown color. The subsoil is a yellow to gray sandy loam to a depth of 30 inches, where there occurs a dense clay. This heavy stratum causes poor drainage conditions. The type is best adapted, in its present condition, for grass for hay and permanent pasture. It is of very small extent. If thoroughly drained it would be a desirable soil for the heavier truck crops and for corn.

GRAVELLY SANDY LOAM PHASE.

The gravelly sandy loam phase includes a number of types of wide distribution, though in most cases of comparatively limited extent.

TABLE LIII.—*Area and distribution of the gravelly sandy loams.*

Name of soil.	State and area.[1]	Acres.
Merrimac gravelly sandy loam	Conn. 1; Mass. 1; N. H. 1, 2	159,060
Dunkirk gravelly sandy loam	N. Y. 3, 5, 10, 12, 15; Ohio 1	60,444
Sioux gravelly sandy loam	Minn. 3	24,448
Williston gravelly sandy loam	N. Dak. 10	12,352
Fishkill gravelly sandy loam	N. Y. 4	9,600
Hoosic gravelly sandy loam	N. Y. 14	8,640
Orono gravelly sandy loam	Me. 2	4,352
Caneadea gravelly sandy loam	N. Y. 5	3,840

[1] For key to numbers in this column, see p. 253.

Merrimac gravelly sandy loam.—The soil of this type ranges from a gray or light-yellowish medium-textured sand to a light-brown loamy sand or sandy loam, with an average depth of 12 inches. Some fine gravel is encountered in the soil and upon the surface. The soil rests upon gravelly beds composed of rounded, waterworn gravel varying in size from small pebbles to large cobblestones. The interstitial material, of which there is relatively a small quantity, consists generally of a yellow coarse sand. The type occurs along stream courses and has a hummocky topography, small hills of gravel with uneven surfaces alternating with depressions or kettle holes. General farm crops are grown upon the soil, but as a rule it

is not a desirable type for this purpose, since the open, leachy nature of the subsoil causes it to be subject to drought. In many cases it is better adapted to the growing of truck crops and to early fruits.

Dunkirk gravelly sandy loam.—The soil is a sandy loam containing from 40 to 60 per cent of small gravel, consisting principally of waterworn shale fragments. The soil is underlain at about 3 feet by shale fragments or sand. It is well drained and early and should be used for early truck crops. It is a desirable soil, with suitable exposure, for grapes for the early market. It is not suited for general farm crops, except corn.

Sioux gravelly sandy loam.—The soil consists of about 12 inches of dark-brown to black loamy sand or light sandy loam, containing a few small gravel and a considerable amount of organic matter. The sand content is made up of all grades from fine to coarse sand or small gravel, but the medium to fine grades usually predominate. The subsoil is composed of layers of gravel and coarse sand, which often occur in strata of uniform thickness. The gravel particles vary in size from coarse sand to small cobbles several inches in diameter, and the interstitial material consists of various grades of sand. The type occupies narrow ridges. There is no very desirable use for this soil at the present time, the rainfall being generally scant and uncertain in the region where the soil occurs. Wheat, oats, flax, barley, and rye are grown with more or less success, depending upon the seasonal variation in rainfall.

Williston gravelly sandy loam.—The soil to an average depth of 12 inches consists of a brown very sandy loam, containing a large quantity of gravel. The clay content, though small, is sufficient in places to give the soil a sticky character when wet. The subsoil is also a sandy loam of relatively high sand content, usually loose and incoherent, and having about the same gravel content as the soil. The gravel in both soil and subsoil ranges from the finest grades to rounded pebbles one-half inch in diameter. The topography is level to rolling. The soil is moderately productive, the yields depending upon the season, and in the absence of markets for vegetable products is used principally for wheat, flax, and rye.

Fishkill gravelly sandy loam.—This type consists of light-brown gravelly loam or sandy loam, about 8 inches deep, changing to yellowish 2 inches below the surface. The surface is covered with rounded gravel 2 to 3 inches in diameter. The quantity increases with depth, and in the subsoil the proportion of coarse material is very high. The type occupies terraces along streams above the first bottom and is marked by rounded knolls with frequent kettle-hole depressions. The slopes are often quite steep and difficult to cultivate, though no large stones or bowlders outcrop. The type lies farther back from the streams than the Fishkill gravelly loam. It owes its origin to

glacial material which has been modified by water action. This material consists chiefly of shale and sandstone, with enough limestone to give it the character of a calcareous soil. The soil is so light and porous as to be of little agricultural value, and is generally used for pasturage.

Hoosic gravelly sandy loam.—The soil consists of a brown gravelly sandy loam 4 to 6 inches in depth. The subsoil is a light to yellow brown gravelly sandy loam of about the same texture. It occurs as terraces and was formed under glacial lake conditions. It is too light in texture for general farming, but is well adapted under intensive methods of cultivation to early truck crops, such as melons, cucumbers, and small fruits, especially strawberries. On the heavier and less gravelly phase of the type corn, oats, rye, potatoes, and buckwheat may be grown with some success.

Orono gravelly sandy loam.—The soil to a depth of 8 or 10 inches consists of a brown gravelly sandy loam. The subsoil is a brownish-gray gravelly sandy loam. The content of rounded and waterworn gravel and stones in soil and subsoil is extremely variable throughout the type, but the subsoil is almost invariably underlain at from 2 to 6 feet by deep cross-bedded sands and gravels. This type is derived from stratified drift deposited with few exceptions in the form of eskers. The soil is loose, friable, well drained, and easily tilled, its value for general farm crops and vegetables depending largely upon depth of soil over the gravel beds. Individual fields are held in high esteem, while others are poor, because droughty.

Caneadea gravelly sandy loam.—The soil is a light gravelly sandy loam, brown to yellowish brown in color. The subsoil is a yellowish-brown to yellow sandy loam. The sand content of both soil and subsoil is medium to fine in texture. Gravel is abundant, but generally small in size. This soil type is adapted to the production of potatoes for the midsummer market, to vine crops, and to berries.

STONY SANDY LOAM PHASE.

TABLE LIV.—*Area and distribution of the stony sandy loam.*

Name of soil.	State and area.[1]	Acres.
Clyde stony sandy loam	Mich. 8	8,000

[1] For key to number in this column, see p. 253.

Clyde stony sandy loam.—The soil is a dark-brown, medium-textured gravelly sandy loam, 18 to 24 inches deep. This is underlain by a sandy loam or mottled brown clay loam subsoil, containing a small quantity of gravel. A characteristic feature is the large number of bowlders strewn over the surface. These occur to a less

extent below the surface. They are mainly of granite, and range from cobbles to angular fragments 2 or 3 feet in diameter. The soil is a good friable sandy loam and with the stones removed produces fairly good crops. The type has level to gently rolling topography and for the most part is fairly well drained. The crops grown are corn, oats, wheat, sugar beets, beans, potatoes, and hay.

COARSE SANDY LOAM PHASE.

TABLE LV.—*Area and distribution of the coarse sandy loam.*

Name of soil.	State and area.[1]	Acres.
Merrimac coarse sandy loam	Conn., 1; Mass., 1	27,904

[1] For key to numbers in this column, see p. 253.

Merrimac coarse sandy loam.—The type is a brown sandy loam, 8 or 10 inches deep, underlain to depths varying from 1 to 2 feet by reddish or yellowish sandy loam, where the material changes to coarse sand and gravel. The surface varies from level to slightly rolling and the drainage is good. This soil is lacustrine in origin. It may be used for all general farm crops of the locality, besides being especially adapted to truck and potatoes. Small fruits do well. In the Connecticut Valley it produces large yields of good quality of cigar wrapper tobacco.

THE FINE SANDY LOAM GROUP.

The soils of the fine sandy loam group as a class are adapted to vegetables that come on the late market, to canning crops, small fruit, tree fruits, for the fall markets, and to a somewhat heavier type of general farming than the sandy loams.

TABLE LVI.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Fargo fine sandy loam	Minn. 1, 3; N. D. 3, 4, 8, 9	432,384
Dunkirk fine sandy loam	Ind. 1; N. Y. 3, 5, 7, 8, 9, 10, 11, 12, 15; Ohio 1, 3; Wis. 4	220,554
Clyde fine sandy loam	Ind. 1; Mich. 6, 8; N. Y. 8, 10; N. D. 1; Wis. 4	74,432
Sioux fine sandy loam	Minn. 5; Neb. 1; N. D. 5	67,328
Podunk fine sandy loam	Conn. 1; Mass. 1; N. H. 1, 2; N. Y. 4	36,228
Lidgerwood fine sandy loam	N. D. 9	10,048
Merrimac fine sandy loam	N. H. 1	8,448
Hudson fine sandy loam	N. Y. 4	6,400
Benoit fine sandy loam	Minn. 3	4,032
Orono fine sandy loam	Me. 2	640

[1] For key to numbers in this column, see p. 253.

Fargo fine sandy loam.—The soil consists of a dark-brown to black very fine sandy loam, having a depth varying from 8 to 24 inches. The amount of organic material in the first few inches is often high, and enough silt and clay is very frequently present to render the soil slightly sticky, under certain moisture conditions. The subsoil is a grayish, brownish, or yellowish fine sandy loam with a depth of 24 to 36 inches. The lower portion often has the nature of quicksand. The topography is level or very gently rolling. When well drained, good crops of corn and fair crops of grain, particularly barley, can be grown. Potatoes, flax, buckwheat, rye, and wheat will do well with good drainage. Some heavy yields of hay are produced. Much of the type is covered with native grasses, and for this reason it is largely used for pasture. When properly drained it is adapted to onions, celery, and cabbage.

Dunkirk fine sandy loam.—The type consists of a gray or light-brown fine sandy loam soil about 10 inches deep, underlain by a yellowish fine sandy loam or fine sand subsoil. It occurs on lake forelands and extends up streams as terraces. The surface is gently rolling to hummocky. Parts of the type have been influenced by wind action. This soil is fairly well adapted to a medium type of general farming, but its chief value on the lake forelands is for grapes, of which it produces very large yields. The grapes are not so sweet, however, nor will they stand shipment so well, as those grown on some of the other soils of this series. Peaches do well on this soil, as do early apples.

Clyde fine sandy loam.—The soil, from 9 to 12 inches, is a very fine sand to fine sandy loam of a brownish-gray or brown color, homogeneous in texture, friable, and easily kept in good tilth. The subsoil is a brown or yellow fine sandy loam extending to a depth of 2 feet or more, where it overlies a clay similar to that forming the subsoil of the Clyde loam. Both soil and subsoil are entirely free of gravel. The surface is slightly undulating to rolling, and drainage varies largely with local topography. Besides general farming and a light type of dairying the production of sugar beets, beans, and potatoes are important interests, and chicory, apples, pears, grapes, and vegetables are only less important products.

Sioux fine sandy loam.—The type is composed of a dark-gray or black fine sandy loam soil from 10 to 15 inches deep, containing a relatively high percentage of organic matter, resting on a subsoil of fine to medium sandy loam of a light-brown color. At from 3 to 8 feet below the surface the material changes to sand and gravel. The surface is generally level. The soil occupies river bottoms and terraces. It generally maintains a good supply of moisture, although in areas of light rainfall irrigation is desirable. The drainage is, on the whole, satisfactory, artificial drains being necessary only in

depressed areas. This is a desirable soil for wheat, corn, oats, barley, and flax. Alfalfa produces well, as do sugar beets. On low-lying areas considerable hay is made from wild grasses.

Podunk fine sandy loam.—The type consists of 10 inches of dark-brown very sandy loam, underlain to 36 inches or more by a yellowish silty fine sand. More or less finely divided mica occurs in both soil and subsoil. This soil occurs principally as flat or slightly undulating first and second bottoms along rivers and large streams. The drainage is usually good. The type is known as a strong, safe, and productive soil for this texture. It is particularly well adapted to corn, potatoes, and cabbage. It is the most desirable soil in the Connecticut Valley for broad-leaf tobacco.

Lidgerwood fine sandy loam.—The type consists of 18 inches of brown or dark-brown fine sandy loam, underlain to 36 inches by a light-brown medium sand, frequently mottled with gray and reddish spots. It occurs in the bottoms and on the bordering slopes and low hills of glacial water courses. The topography varies from nearly level to rolling and the drainage is usually good. This soil is well adapted to potatoes and truck crops, and is a fair type for general farm crops.

Merrimac fine sandy loam.—The soil to an average depth of 8 inches consists of a light-brown fine sandy loam. The subsoil is a yellow fine sandy loam grading into yellow fine sand. The subsoil usually rests upon gravel at a depth of 36 inches or more. The type occurs as narrow terraces along the river and represents glacial flood plains deposits. It lies from 10 to 50 feet above the level of the river. Grass for pasturage and hay constitutes the principal crop. The areas of this soil are largely occupied by residences.

Hudson fine sandy loam.—The soil consists of 8 inches of light-brown or dark-brown silty fine sandy loam. The subsoil is composed of a similar material, except that it is lighter colored and more compact than the soil. It is underlain by beds of clay. This soil occurs as hilly to rolling areas, with good natural drainage. It is used extensively as molding sand. It is particularly well adapted to truck crops, apples, pears, and small fruits.

Benoit fine sandy loam.—The soil consists of a black to dark-brown fine sandy loam, with an average depth of 12 to 15 inches. It contains a relatively large quantity of organic matter, and a few small bowlders are sometimes encountered scattered at intervals over the surface. This surface material grades into a subsoil consisting of a gray to yellow sandy loam, becoming lighter in texture as the depth increases, until at 25 to 30 inches it is a yellow to gray fine sand, containing gravel and small cobbles. This subsoil is underlain by beds of gravel, which usually occur at a depth of 30 to 36 inches, but are sometimes encountered nearer the surface. The type

occupies low, basinlike depressions occurring between ridges. The surface of the type as a whole is gently undulating, but a large part is poorly drained. Only a very small proportion of the type is under cultivation, the most of it being used for hay and pasture land. The better drained areas are not productive during a dry season, and during a wet season the greater part of the type is too wet and poorly drained to be of much agricultural value.

Orono fine sandy loam.—The type consists of a grayish-brown incoherent fine sandy loam, 8 inches deep, underlain to 20 inches by mottled brown and gray fine sandy loam, with a thin layer of hardpan at 18 inches. Stiff blue clay is encountered at about 30 inches. The surface is flat and the type is poorly drained. It is a poor soil in its natural undrained condition, but can be made a good soil for general farm crops by thorough underdrainage.

THE LOAM GROUP.

The loams of this province are very important for canning crops, as they produce large yields of firm, fine quality. They have among them also some of the best soils for fruit, particularly apples and pears. They are adapted to a moderately heavy type of general farming and to the light type of dairying, where pastures are used as an important source of feed supply.

TABLE LVII.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Clyde loam	Ind. 1, 7; Mich. 1, 2, 5, 8; N. Y. 5, 9, 10; N. D. 1, 2	561,068
Fargo loam	Minn. 3, 4; N. D. 3, 4, 8, 9	323,968
Dunkirk loam	N. Y. 1, 5, 9, 10, 12; Ohio 3	232,768
Sioux loam	Ill. 10; Ind. 5, 10; N. D. 8	73,920
Chapman loam	Me. 1	27,648
Tonawanda loam	N. Y. 10	15,168
Suffield loam	Conn. 1; Mass. 1	18,878
Livingston loam	N. Y. 5	13,504
Superior loam	Minn. 2; Wis., 7, 8	5,824
Washburn loam	Me. 1	5,504
Vergennes loam	N. Y. 13; Vt. 1	4,352
Caneadea loam	N. Y. 5	4,160
Hudson loam	N. Y. 4	3,904
Bearden loam	N. D. 8	3,584
Elmwood loam	Mich. 1	3,810
Mankato loam	Minn. 1	1,600
Fishkill loam	N. Y. 4	1,600
Warners loam	N. Y. 5, 11	832

[1] For key to numbers in this column, see p. 253.

Clyde loam.—The type ranges from a moderately friable loam to a rather heavy compact loam of a dark-gray, brown, or black color, from 8 to 12 inches deep, resting upon a drab colored sandy or silty

clay, somewhat streaked and mottled with iron stains. On account of former inadequate drainage much of the soil is still in a puddled and compact state, sticky, and pervious when wet and very hard when dry. This condition is emphasized in low-lying areas that have been cultivated only a short time. In its natural state the soil possesses marked clayey properties to within a few inches of the surface, where there is an accumulation of organic matter. In the better drained areas the soil is mellow and the subsoil, too, is more friable and pervious to water. The almost level surface, with occasional low knolls and swells and intervening shallow depressions, naturally cause poor drainage. When properly drained and cultivated large yields are secured. The principal crops grown are corn, oats, wheat, and hay. This is one of the best soils for sugar beets. It is well adapted to canning crops and late cabbage, as well as to fruit, particularly apples and pears.

Fargo loam.—The type consists of 10 or 12 inches of black loam, underlain to about 36 inches by a yellowish or drab, heavier loam subsoil. Occasionally there are layers of sand below 24 inches. The type occurs as low, flat areas with no drainage channels and a large part of it is too wet for cultivation. It is largely in an unreclaimed condition and left in native prairie and slough grasses. Better drained portions produce some timothy and prairie grass. If well drained it should be used for wheat, oats, flax, hay, and pasture.

Dunkirk loam.—The soil is a light or dark brown loam 10 inches deep, generally containing considerable sand, which renders it easy to cultivate. The subsoil is a yellow or light-brown fine sandy loam, usually rather compact, becoming darker in color and heavier in texture with depth. A small quantity of stone occurs in soil and subsoil, but the quantity is seldom great enough to interfere with tillage. The surface is undulating and usually well drained. The soil is desirable for general farm purposes, producing good yields of corn, oats, barley, buckwheat, and potatoes. Fruit, especially apples and pears, and most vegetables do well, especially in production for canning and for the winter market.

Sioux loam.—The soil consists of a brown, slightly sandy loam about 10 inches in depth. The surface is friable, easily worked, free from stones, and generally quite level. The subsoil has a depth varying between 20 and 40 inches, and consists of a brownish-yellow loam. It is underlain by a reddish-gravelly loam overlying a bed of gravel. The type constitutes the higher terraces formed by rivers during the close of the glacial epoch. It is admirably adapted to the production of crops for canning purposes, but is at present largely used for general farming.

Chapman loam.—The type is quite variable in character. A striking characteristic is seen in the hummocky surface. These hummocks,

with a diameter of 4 or 5 feet and an elevation of a foot or two above the intervening depressions, consist for the most part of a bright-yellow to brown, rather coarse loam, which is somewhat gravelly. At about 12 inches a sticky loam somewhat lighter in color is encountered. This becomes heavier with depth and at from 24 to 30 inches grades into the compact silt loam or silty loam of a lower till. On other mounds the unweathered whitish till is found at the surface, while in still other cases the soil may consist of a light to yellowish-gray loam mottled with brown iron stains. In the depressions the material may consist of a grayish silt loam similar to the lower till, covered with 6 to 8 inches of vegetable mold or muck, or others may be merely a mass of rock underlain by the grayish lower till. The type occupies low country about the sources of large streams or along stream courses. Some of it, locally known as "blueberry bog," supports a thick growth of blueberry bushes, alder, moss, etc. The better drained portions produce fair yields of grass and grain.

Tonawanda loam.—The soil consists of a brown to black fine mellow loam varying from 8 to 16 inches in depth. The subsoil consists of a drab or yellow and brown mottled clay loam or loam to a depth of 24 to 30 inches. This heavy material is underlain by a light-yellow loam or sticky sandy or silty loam extending to a depth of 3 feet or more. Frequently the last few inches of the section is a sticky sand. Both soil and subsoil are devoid of coarse material. The surface of the type is low and flat with occasional slight elevations along stream courses. The chief crops grown are corn, oats, hay, and potatoes. During favorable seasons fair yields are produced, but crops are lost on an average of one year out of three. On the higher lying portions crops are more certain. The soil is not well adapted to fruit. It could be improved by drainage and thorough tillage, but it is doubtful if this would be justified at the present time.

Suffield loam.—The soil is a dark sandy loam, 8 inches deep, under which is a layer from 12 to 28 inches thick of a rather compact sand, which rests on heavy impervious drab clay. The impervious nature of the underlying clay renders the type wet and poorly drained. There is a slight formation of iron hardpan in the soil. When properly drained, corn, small grains, and grass give moderate yields.

Livingston loam.—The surface soil of this type is almost identical with the surface soil of the Dunkirk loam. It has a depth of about 1 foot, and is grayish-brown in color. The subsoil is a heavy silty clay, olive to drab in color. The surface soil is derived from glacial lake deposits foreign to the locality, while the subsoil is derived from the weathering of the underlying soft shales. It is poorly drained. When underdrained it is adapted to the production of corn, wheat, oats, and hay, and to the heavy truck crops.

Superior loam.—The soil, which has a depth of 8 to 14 inches, is a brown loam, carrying a small amount of gravel. The subsoil is a heavy loam, usually lighter in color than the soil, and grades into a stiff, brownish-red clay, at from 18 to 24 inches. On the surface are stones and bowlders, though not in sufficient quantity to interfere with cultivation. The surface is rolling and natural drainage is generally good. It is fairly adapted to hay, oats, and wheat.

Washburn loam.—The soil is a dark-brown or black silty loam, 12 inches deep. The subsoil is a silty loam, mottled grayish-yellow, brown, and yellow, and underlain at about 36 inches by a yellowish sandy clay. The surface is strewn with granite, gneiss, and sandstone bowlders. Many small shale and slate fragments occur throughout the soil and subsoil. The depth to the underlying limestone is greater than in case of the Caribou loam. This soil occurs as narrow strips along the streams, in the depressions which the drainage waters follow, in small isolated depressions, and as marginal fringes to Muck areas. Drainage conditions have favored the accumulation of a large amount of organic matter in the soil. The type is intermediate between the Caribou loam and Muck, and to a certain extent has the characteristics of each. It is especially adapted to grass. Oats and buckwheat do moderately well. Large yields of potatoes are secured, but they are decidedly inferior to those produced on other soils of the area.

Vergennes loam.—The soil is a heavy fine sandy loam with an average depth of 10 inches. The subsoil is either a plastic mixture of clay and sand or a medium to heavy loam which often grades at 3 feet into a stiff clay similar to the subsoil of the Vergennes clay. The subsoil occasionally contains a small percentage of gravel and stone. The type occupies level areas or low, rounded, or flat-topped hills and gentle slopes. It is a desirable soil for corn, and also produces good crops of hay, oats, and barley. It is suitable for canning crops and for heavy truck crops for the winter markets.

Caneadea loam.—The soil is a mellow loam, yellowish-brown in color, with a depth of 8 or 10 inches. The subsoil to 36 inches in depth is a light loam. There is always a considerable percentage of shale and fine-grained sandstone fragments, with some rounded gravel, in both soil and subsoil. This soil is adapted to general farm crops. Potatoes are especially suited to it as well as vine crops and berries.

Hudson loam.—The type consists of 8 or 10 inches of a light-brown to dark-brown or heavy sandy loam, underlain to about 36 inches by a light-colored, compact, gravelly sandy loam. Below 36 inches gravelly material is encountered, and this continues to a considerable depth. The soil has a coarse feel, owing to the presence of some coarse sand and fine gravel. The surface is flat, but the

drainage is good. In dry seasons the soil holds moisture well. It is an early soil for this group and especially adapted to potatoes, tomatoes, and root crops, as well as to general farming. It is not a desirable fruit soil.

Bearden loam.—The type is composed of a dark loam surface soil, from 14 to 20 inches deep, underlain by a gray or sometimes yellow loam or silty loam subsoil. Fragments of shale are frequently encountered, and at depths ranging from 3 to 6 feet below the surface is often found a water-bearing sand. Generally the soil is entirely free from stones and gravel, but in some small areas glacial bowlders are seen. The type is fairly level and nearly all of it is sufficiently well drained to produce good crops. At present it is devoted chiefly to small grains, flax, and wild hay, of which the yields are good. In the better-drained portions alfalfa will do fairly well. It is too inaccessible to the larger markets to be used for vegetables or fruits.

Elmwood loam.—The type consists of a dark-brown fine sandy loam, 2 feet in depth, overlying a close, poorly drained clay. It occupies level terraces along the Connecticut River and has very little present agricultural value, on account of its compact nature and poor underdrainage. It is not an easy soil to improve, and it would hardly be desirable to improve it at the present time for agricultural use.

Mankato loam.—The soil is a heavy, stiff, black loam to clay loam, from 1 foot to 2 feet in depth, resting directly upon a bed rock of limestone or sandstone. A few inches of the material immediately overlying the rock is reddish brown in color and sandy in texture. Gneissic and granitic bowlders, varying from 1 to 6 or more feet in diameter, occur so thickly in places as to render the soil unfit for anything but pasture. In wet seasons trouble is experienced in cultivating the soil, necessitating the use of a large part of it for hay or pasture land. On the other hand, in seasons of drought crops suffer badly from lack of moisture. With favorable seasons good crops of corn are grown, though the soil is best adapted to wheat. The reclamation of the land would be of doubtful economy at the present time, on account of its isolated position.

Fishkill loam.—To a depth of from 8 to 12 inches this is a gravelly dark-brown loam or silty loam, and is underlain by a gravelly material of lighter color, changing to yellowish at about 24 inches, where it rests on a gravelly or sandy substratum. Occasionally a little rounded gravel is found upon the surface. It occurs on gravelly terraces above overflow, though some areas of depression are wet enough to require drainage. This material consists chiefly of shale and sandstone, with enough limestone to give the type the character of a calcareous soil. Where well drained, good yields of corn for fodder purposes are produced. Applications of lime are desirable on

some areas. This soil is derived from glacial material deposited as outwash or in comparatively swift water along stream courses.

Warners loam.—The type consists of 10 inches of mellow brown loam, containing many calcareous nodules and a considerable proportion of marl, resting on a subsoil of white or gray marl. The surface soil is silty in character and of soft, unctuous feel. Thin layers of muck occur at various depths. The type produces fairly good crops of corn and grass.

GRAVELLY LOAM PHASE.

The gravelly loam phase embraces an important variation from the typical loam group. Some of the types are of relatively wide distribution and of considerable extent. Their value for agriculture depends chiefly upon the gravel content, being, where the content is low, but little if any inferior to the typical loam soils.

TABLE LVIII.—*Area and distribution of the gravelly loams.*

Name of soil.	State and area.[1]	Acres.
Dunkirk gravelly loam	N. Y. 1, 2, 3, 5, 8, 9, 11, 12; Ohio 3	126,016
Chenango gravelly loam	Ind. 5; Mich. 7; Ohio 4, 5, 7, 9, 10	71,232
Fargo gravelly loam	N. D. 3, 4, 9	57,664
Fishkill gravelly loam	N. Y. 4	41,216
Sioux gravelly loam	Minn. 5; N. D. 8	32,704
Caneadea gravelly loam	N. Y. 5	4,992
Vergennes gravelly loam	N. Y. 13; Vt. 1	3,968

[1] For key to numbers in this column, see p. 253.

Dunkirk gravelly loam.—The soil varies from a light-brown to brown loam, averaging 10 inches in depth, containing from 20 to 50 per cent of rounded, waterworn gravel, principally shale. The subsoil is a yellowish-brown loam, usually heavier than the soil and with a somewhat higher gravel content, which increases with depth. The type occurs as stream and lake terraces. Its position and the porous nature of the subsoil promote thorough drainage. The soil is mellow and easily tilled, the stones seldom being large or numerous enough to offer much resistance to cultivation. Most of the ordinary farm crops do well on this soil, particularly corn and oats. Fruits also do well. It is one of the important grape soils.

Chenango gravelly loam.—The soil is a brown or reddish loam 12 inches deep, containing 15 to 30 per cent of rounded gravel. The soil is underlain to a depth of 24 inches by a stiff tenacious clay loam, which is in turn underlain by gravel. The type occupies level or gently rolling river terraces. It is recognized as a fine soil for general farm crops, for canning fruits, and for apples.

Fargo gravelly loam.—The type consists of a dark-colored loam or sandy loam, 10 to 12 inches deep, underlain to 2 or 3 feet by a lighter colored, coarser textured material. Scattered upon the surface and disseminated through the soil and subsoil are varying quantities of gravel. Sometimes larger fragments of crystalline rock and shale are present also. At depths ranging from 3 to 10 feet the type is often underlain by beds of gravel and sand. The surface features vary from undulating to rolling, and the drainage is inclined to be excessive. The type is used in places for wheat, oats, and corn. Considerable areas are still in prairie grass.

Fishkill gravelly loam.—Light brown loam or heavy sandy loam, about 8 inches deep, containing some rounded and some flat shaly gravel. The subsoil is yellowish, gravelly loam, or heavy sandy loam of about the same texture, but containing rather more gravel. The type occupies terraces above the first bottom along stream courses, and the topography is flat or gently undulating with occasional kettle holes. It owes its origin to glacial outwash and glacial material reworked by streams, very often showing cross-bedding. The material consists chiefly of shale and sandstone, with enough limestone to give the soil a calcareous character. The soil is light and friable and easily cultivated, though on account of its leachy character crop yields are generally light. It produces corn, potatoes, and some of the truck crops, and in favored locations it is also a fair fruit soil.

Sioux gravelly loam.—The type consists of a dark loam or heavy sandy loam, containing a noticeable quantity of coarse sand particles, underlain by a yellow stratum of about the same texture, and of a depth of 8 to 24 inches. Beneath this occurs a layer of coarse sand a few inches thick, which rests on a bed of gravel. The latter is nearly always stratified and varies in extreme cases from a coarse sand on the one hand to the coarsest gravel and bowlders on the other. Most of the type may be described as level or gently rolling. A large proportion of it is unbroken and used for pasture or hay, which is scant in dry seasons. On the cultivated areas fairly good crops of wheat, barley, flax, etc., are secured in favorable seasons, but practically nothing in dry seasons.

Caneadea gravelly loam.—The soil of this type is a light to dark brown gravelly loam to a depth of 6 or 8 inches. The subsoil to 36 inches is a yellowish-brown to ocher-colored gravelly loam. Rounded stones and coarse gravel are abundant in both soil and subsoil. The areas of this soil are well drained and quite easily cultivated. They are devoted to general farming, and the yields are usually satisfactory, though sometimes cut short by drought.

Vergennes gravelly loam.—The soil is a sandy loam from 6 to 10 inches deep, containing from 10 to 45 per cent of fine gravel, pebbles, and small stones. The subsoil consists of light loam or sticky sandy

loam with a gravel content similar to that of the soil. In its lower depths the subsoil often grades into sand, with a high content of fine gravel. The type occupies two topographic positions: Low bars and ridges surrounded by the Champlain clays of the region, where it represents delta deposits, and broken terrace formations along the ancient shore line. On account of its texture and position the soil is well drained and is susceptible to drought. On the more loamy areas fair yields of corn and hay are secured. The soil is well adapted to the production of potatoes.

STONY LOAM PHASE.

The stony loam phase is less important than the gravelly loam phase. The number of included types is less than in the case of the latter phase; their development so far as indicated by surveys completed up to January 1, 1910, is less extensive and their agricultural value generally lower.

TABLE LIX.—*Area and distribution of the stony loams.*

Name of soil.	State and area.[1]	Acres.
Dunkirk stony loam	N. Y. 7, 11	41,920
Vergennes stony loam	N. Y. 13, 14; Vt. 1	18,304
Superior stony loam	Minn. 2	8,704
Honeoye stony loam	N. Y. 5	2,304

[1] For key to numbers in this column, see p. 253.

Dunkirk stony loam.—The soil is a gray or brown sandy loam containing a large percentage of stone and gravel of different sizes. This overlies a yellowish-brown sandy loam subsoil generally extending to about 36 inches. The subsoil is underlain by gravel and sand at varying depths. The topography ranges from nearly level or gently undulating where it occurs in the Ontario Lake plains to quite hilly, where it is developed upon small drumlins. Where rolling the natural drainage is good, though level areas require ditching. The soil is derived from glacial material subjected to subsequent glacial lake action. Where not too steep and stony for cultivation wheat, oats, and corn do well, and fruits also give good yields.

Vergennes stony loam.—The soil consists of a clay loam or loam, with an average depth of 8 inches. The subsoil is a gray clay similar to that giving the Vergennes clay. Its depth is variable, depending on the position of the underlying rock. The type usually occupies long, narrow ridges or low hills, and also the lower slopes of higher hills. Outcrops of limestone occur, and large quantities of limestone fragments are found scattered over local areas. Much of the type is

still in pasture and woodland. The more level areas give medium yields of corn and hay. The soil is best suited to fruits, especially apples, an excellent quality of which is produced.

Superior stony loam.—The type consists of 12 inches of light-brown loam, underlain by a loam grading into red clay at from 22 to 36 inches. On the surface and mixed with the soil are stones and bowlders in considerable quantity. The surface is rolling and hilly and the natural drainage is generally good. It is a glacial soil and where not too rough and the stones are not too numerous is used to some extent for oats, hay, and wheat.

Honeoye stony loam.—The type consists of a brown loam, from a few inches to about 1 foot in depth, filled with fragments of limestone, and resting either upon a mass of broken stone or upon the solid bed rock. The type is best suited for pastures. Where the soil covering is deepest alfalfa can be produced.

SHALE LOAM PHASE.

So far but one type of the shale loam phase has been encountered in the province under consideration. This type is, however, of peculiar agricultural value on account of its special adaptation to grape culture. Future surveys will doubtless show a considerable extension of soil of this type.

TABLE LX.—*Area and distribution of the shale loam.*

Name of soil.	State and area.[1]	Acres.
Dunkirk shale loam	N. Y. 2, 3, 12	14,592

[1] For key to numbers in this column, see p. 253.

Dunkirk shale loam.—The soil is a light-gray loam 10 inches or more in depth, containing considerable silt and fine sand. The subsoil, to a depth of 24 inches, is of the same texture as the soil, but lighter in color, and contains large quantities of angular shale fragments or bowlders. This is the best soil for early grapes, which have better keeping and shipping qualities than those grown on the lighter soils or on the Dunkirk loam. The grapes are sweet and well adapted to the making of wine. With liberal manuring general farm crops may be grown.

THE SILT LOAM GROUP.

There is a surprisingly small amount of silt loam in this province, considering the source of the material.

TABLE LXI.—*Area and distribution of the silt loams.*

Name of soil.	State and area.[1]	Acres.
Fargo silt loam	Minn. 3, 5; N. D. 4, 8, 9	108,288
Dunkirk silt loam	N. Y. 2, 3, 5, 7, 8, 10, 11, 12	101,632
Podunk silt loam	Conn. 1; Mass. 1; N. H. 2	75,812
Sioux silt loam	Ill. 10; Ind. 10; Minn. 5; Wis. 2	40,570
Superior silt loam	Minn. 2	16,192
Orono silt loam	Me. 2	14,464
Caneadea silt loam	N. Y. 5	10,752
Hoosic silt loam	N. Y. 14	4,288
Clyde silt loam	Mich. 8	3,904
Hudson silt loam	N. Y. 4	1,088

[1] For key to numbers in this column, see p. 253.

Fargo silt loam.—The soil is a black to dark-brown silt loam about 14 inches deep, the upper layer of which contains a large quantity of decomposing organic matter. The subsoil is a yellow or grayish silt loam or silty clay. The type is level to gently rolling. It is a productive soil well adapted to grass and small grain and largely under cultivation. Wheat, oats, barley, and flax give good yields. Late vegetables and garden truck are grown with excellent results. Well-drained areas also produce corn, clover, alfalfa, and sugar beets.

Dunkirk silt loam.—The soil to an average depth of 10 inches consists of a pale-yellow to light-brown silt loam. This is underlain by a slightly heavier subsoil of a brown or chocolate color. The type occupies lake forelands and the higher terraces along streams. It produces good yields of general farm crops, berries, and tree fruits, and the later truck crops.

Podunk silt loam.—The type consists of about 12 inches of a dark-brown silt loam, underlain by lighter colored silt loam grading into drab and yellow mottled silt loam which, in turn, at an average depth of 20 inches, rests upon a very compact fine sand of a drab color. Throughout the soil and subsoil is found finely divided mica, which makes the material feel slightly greasy. Areas of this type occupy level, depressed areas on stream terraces. Drainage is necessary and is accomplished both by open ditches and covered drains. This soil is best adapted to grass and gives good yields of hay. Where the drainage conditions are good large crops of ensilage are produced. The soil should also be used for heavy truck, such as cabbage, celery, and onions. It is a desirable soil for an intensive form of dairying.

Sioux silt loam.—The type consists of a dark-brown, friable silt loam, 12 inches deep, underlain by a reddish-yellow, heavier silt loam, which in turn is underlain by sand or gravel at from 5 to 8

feet. The type occurs as terraces along streams. The surface soil is gently rolling. The underlying gravel bed affords good underdrainage. This is an exceedingly fertile soil, very highly esteemed, especially for corn and small grain.

Superior silt loam.—The type consists of 6 to 10 inches of light silt loam, underlain by a very fine sandy loam or silty loam, grading into a stiff, red clay at varying depths. The surface is usually rough and broken and often deeply eroded by streams. On account of uneven topography the type is not of much value for agriculture.

Orono silt loam.—The soil to a depth of 8 or 10 inches is a light-brown friable silt loam. The upper part of the subsoil is an ashy gray silt loam, but the texture gradually becomes heavier with depth, passing through a silty clay loam to clay loam or clay. The surface is very gently undulating and drainage is well established. The native growth was largely white birch. The type is free of stones and is extensively cleared and cultivated. It is one of the best soils of the locality (central Maine) for general farm crops, including potatoes.

Caneadea silt loam.—The soil of this type is a mellow silt loam, pale-yellow to gray or dingy white in color, and having a depth of 10 inches. The subsoil to a depth of 36 inches is a pale-yellow, yellowish-brown, or light drab silt or silt loam. Practically no stones or gravel are found in either soil or subsoil. This soil is easily eroded and, if left bare, gullies badly. It is adapted to the production of hay and corn for ensilage. It should be used for dairy farming.

Hoosic silt loam.—The surface soil is a light-brown silt loam 6 to 12 inches deep. The subsoil is a pale-yellow compact silt loam. The type is derived from quiet water deposits laid down upon high terraces and deltas. It is well adapted to grass and grain crops and, where well drained, to corn and potatoes.

Clyde silt loam.—The type consists of a light-brown to chocolate-brown silt loam 10 inches deep, resting upon a lemon-yellow material of similar texture, containing little or no organic matter. The texture is very uniform to a depth of 3 feet, and gravel is entirely absent, but there are some bowlders strewn over the surface. The soil is very friable and easily kept in good tilth. It has somewhat rolling topography and fairly good drainage. It is well adapted to grain and hay and is used for general farm crops and for the production of chicory.

Hudson silt loam.—The soil to a depth of 8 inches varies from a light-brown silt loam to a heavy fine sandy loam. The subsoil to a depth of 36 inches is yellowish silt loam, which often becomes drab in the lower depths. The type occupies a terrace above streams, and has a rolling to flat surface. The drainage is fair. In the higher

locations the soil is adapted to corn and cabbage, and in the lower, poorly drained locations it is best adapted to hay and pasturage.

THE CLAY LOAM GROUP.

As a rule the silt loams, clay loams, and clays are very heavy soils to handle and require heavy farm equipment. They produce the heavier farm crops, and many of the types are adapted to an intensive form of dairying, where the cattle are kept up most of the time and fed rather than pastured. Vegetables and fruits mature late, with good quality and large yields, and are especially adapted for canning or storage for the winter markets. The soils are generally too heavy for corn, are better adapted to wheat, and unexcelled for grass.

TABLE LXII.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Fargo clay loam	Minn. 1, 3, 5; N. D. 3, 9; S. D. 2	601,024
Dunkirk clay loam	Mich. 10; N. Y. 1, 8, 10, 12; Ohio 8	128,768
Poygan clay loam	Wis. 7	23,232
Clyde clay loam	Mich. 10; N. Y. 9; Wis. 4	16,960
Hudson clay loam	N. Y. 4	9,984
Sioux clay loam	Ind. 4	2,240
Superior clay loam	Wis. 7	1,152

[1] For key to numbers in this column, see p. 253.

Fargo clay loam.—The soil consists of 12 to 24 inches of a dark-brown to black clay loam, usually containing a large percentage of organic matter. The surface material, to depths ranging from 4 to 8 inches, is often mucky in the more pronounced depressions. The subsoil is a heavy drab to gray, grayish-brown or bluish-black silty clay to clay, often having a finely stratified structure. Though the type has a very rolling topography much of it is poorly drained, and large areas are entirely too wet for agricultural uses. The relatively large quantity of organic matter in the soil renders it loamy, friable, and easily cultivated when drained, but when wet it is sticky and tenacious, clods badly, and does not scour well, making plowing exceedingly difficult. When well drained this type is a valuable soil for general farming. The principal crops are corn, wheat, oats, flax, and millet. Barley, timothy, and hemp are raised to some extent. The soil is not particularly adapted to rye, potatoes, or vegetables.

Dunkirk clay loam.—The soil is a dark-brown to grayish-brown clay loam with a depth of 8 inches. It is quite stiff and heavy and cracks upon drying. The subsoil is a mottled brown and gray heavy clay loam or clay. Both soil and subsoil are generally free from

stones or gravel, although small quantities are sometimes found locally. The type occupies gently undulating areas and the slopes of hills, which are sometimes quite abrupt. The drainage is adequate in some locations, but in nearly level or depressed areas it is often necessary to resort to artificial drainage. On account of its heavy, compact nature the subsoil is almost impervious to water. The soil is well adapted to wheat, and grass and corn also do fairly well. Alfalfa may be successfully grown. It produces grapes of good quality.

Poygan clay loam.—This type to a depth of 10 inches consists of dark-brown to black heavy loam or clay loam, which is underlain to a depth of 36 inches by a heavy pinkish-red clay. It is easily tilled, owing to its large content of organic matter. The type is derived from the weathering of lacustrine sediments deposited at a time when the Great Lakes stood at a higher level than at present. It occupies low, level, to slightly undulating areas, and the depth of ground water is usually only a few feet.

Clyde clay loam.—The type consists of a dark-brown or black clay loam from 8 to 14 inches deep, resting upon a yellow or drab-colored clay, often streaked with iron stains. The subsoil is plastic when wet and contains very little coarse sand or fine gravel, excepting along stream courses, where coarse material may be encountered within the third foot. The type occupies level areas, and the drainage is very poor. Comparatively few areas are under cultivation. Corn, oats, and hay are the principal general farm crops. Cabbage, onions, and celery are quite extensively grown on some parts of the type. Nearly all the area is capable of improvement through drainage, and when reclaimed will prove to be a good soil for both general farming and trucking.

Hudson clay loam.—The type consists of 6 or 7 inches of light-brown to drab silty clay loam, underlain by a plastic silty clay, which in the lower depths grades into a stiff tenacious silty clay of mottled drab, blue, and yellow color. The surface is usually flat and poorly drained, but in places has been deeply eroded. This is a cold, wet soil, and when dry the surface bakes and cracks and crops suffer from drought. It is used extensively for brick making. Not well adapted to cultivated crops, but is especially good for grass. The texture of the soil and adaption to crops are greatly improved by the application of lime and coarse manures and by drainage.

Sioux clay loam.—The soil to a depth of 8 to 14 inches consists of a brown mellow clay loam. The subsoil is a yellow clay loam or clay which usually becomes heavier below 24 inches. Throughout the soil and subsoil a small amount of rounded gravel is disseminated. The type is underlain usually by sandy or gravelly material, and on this account the major portion has excellent drainage. Seepage

waters from adjacent slopes or higher lands give rise to local conditions of poor drainage. The type occupies nearly level terraces representing reworked glacial material deposited under glacial lake conditions. The type is used largely for corn, wheat, grass, and truck crops, such as cabbage and tomatoes, giving moderately good yields. Berries and potatoes find the soil well suited to their requirements.

Superior clay loam.—This is a light-brown or reddish loam grading into a light-red or light chocolate red silty clay at about 8 inches. The topography is level to gently sloping in character and the water table is usually only a few feet below the surface. The type is derived from the weathering of lacustrine sediments deposited at a time when the Great Lakes stood at a higher level than at present. Artificial drainage is usually necessary. Good yields of staple farm crops are secured where the soil has adequate drainage.

THE CLAY GROUP.

The soils of the clay group as a class are very heavy to handle and require the heaviest farm equipment. Corn ceases to be a desirable grain crop, but continues important as an ensilage or stover crop. Wheat is the principal grain crop and hay the most important farm crop. The most intensive type of dairying is practiced on such soils. The vegetables grown are chiefly the heavy kinds stored for winter markets. Fruit also matures late crops for storage and winter use.

TABLE LXIII.—*Area and distribution of the clays.*

Name of soil.	State and area.[1]	Acres.
Clyde clay	Ind. 1, 3; Mich. 8, 9; N. Y. 10; N. D. 1; Ohio 5, 8.	301,312
Vergennes clay	N. Y. 13, 14; Vt. 1	222,976
Superior clay	Mich. 4; Minn, 2, 6; Wis. 1, 8	198,784
Dunkirk clay	N. Y. 1, 5, 7, 8, 9, 10, 11, 15; Ohio 1, 3	189,250
Fargo clay	Minn. 1; N. D. 3, 8, 9	158,272
Suffield clay	Conn. 1; Mass. 1	23,610
Poygan clay	Wis. 7	9,600
Lockport clay	N. Y. 10	6,656
Sioux clay	N. D. 5	2,432
Caneadea clay	N. Y. 5	1,280

[1] For key to numbers in this column, see p. 253.

Clyde clay.—The soil is a silty clay loam of a brown or black color, 6 to 9 inches deep. Where the proportion of organic matter is higher, the color is darker and the texture more loamy and friable. The subsoil is a bluish or drab-colored clay, very tenacious, and practically impervious to water. The type occupies low, wet, level

areas, some of which were originally covered with peat. With good drainage the type is well adapted to general farm crops, especially adapted to grass and dairying, and a fine soil for the production of sugar beets.

Vergennes clay.—The surface soil consists of heavy gray clay, varying in depth from 6 to 12 inches. The subsoil is a gray, drab, or light-brown heavy clay, somewhat tenacious when wet, but extremely stiff, compact, and intractable when dry. Wherever the soil is so shallow that the plow goes below it, the upturned furrows of the underlying gray clay become white upon exposure, and this has given rise to the local term "whitefaced clay." On the steep slopes of many ridges outcrops of slate are frequent, and thin fragments of this rock are often strewn over the tops of the steeper slopes. The type for the most part is level or gently rolling, broken only by occasional ridges. Except in the depressions it has sufficient surface drainage. As the greater part of this soil is compact and impervious to moisture, underdrainage is needed to give the best crop returns. The soil is admirably adapted to hay production and dairying, and with efficient drainage it gives good yields of corn, oats, and barley.

Superior clay.—The type consists of a heavy, compact, and almost impervious red clay, with no apparent difference in color or texture between soil and subsoil. When wet it is a bright brick-red color and quite adhesive and gummy; when dry it is traversed on the surface by cracks an inch or more in width; and when broken the soil falls into cubical blocks. Sometimes there are small fragments of rock in both soil and subsoil, and usually upon new ground there is an inch or so of vegetable mold. The type occurs generally in broad, flat areas, with surface sloping toward the streams. It is very retentive of moisture and adapted to timothy and clover. It improves with use, and potatoes, Canadian peas, and beets are successful crops. Other root crops are grown under proper systems of cultivation.

Dunkirk clay.—The type consists of a drab or gray clay 6 to 12 inches in depth, underlain by a tenacious mottled clay, beneath which at a depth of 4 to 10 feet occurs the typical bowlder clay. Near ancient beach lines the soil is sometimes underlain by gravel. The type is found upon lake forelands and in river valleys. Some areas are poorly drained and most of it would be improved by drainage. The soil is admirably adapted to wheat and hay. It is too heavy for corn for grain, but gives good yields of corn for fodder or ensilage. It is adapted to apples and pears for the late winter markets. When properly drained it is, next to the Dunkirk shale loam, the best soil for grapes, of which it gives a late crop of marked sweetness and good shipping and keeping qualities.

Fargo clay.—The type consists of a heavy black clay, 6 to 14 inches deep, underlain by gray or blue clay of the same texture. At from 5 to 9 feet there occurs a mottled gray, brown, and yellow clay, similar to the subsoil of the Miami black clay loam. When wet this type is very waxy and gummy and has an oily feel. It is exceeding slippery underfoot and often sticks to wagon wheels in great quantities. The type occurs in depressions in the upland. The drainage is poor and the soil is difficult to till. It is a very strong and productive soil when well drained and is adapted to the general farm crops of the Northwest, especially to wheat, oats, barley, flax, and corn.

Suffield clay.—The type is composed of a clay loam 12 inches deep, underlain by a close-textured, laminated clay subsoil. It occupies level areas of deficient drainage in the Connecticut Valley. On account of its poorly drained condition and close structure the soil is not adapted at present to any agricultural purpose, although used to some extent for pasture. The structure is such as hardly to justify improvement under the present development of agriculture.

Poygan clay.—The soil of this type, to a depth of about 10 inches, is a dark-brown to black, heavy loam, underlain by a pinkish-red clay which, in some instances, is mottled with white. This is sometimes succeeded by a stratum of water-saturated sand. The surface contains considerable organic matter and tillage is not especially difficult. This type is derived from the weathering of lacustrine sediments deposited at a time when the Great Lakes stood at a higher level than at present. The type occupies level areas in old lake bottoms and always requires artificial drainage. It is well adapted to grass and produces good yields of corn and oats.

Lockport clay.—The type is composed of a heavy red to brown clay loam soil from 4 to 8 inches deep, underlain by a stiff Indian-red clay subsoil. Under most of the type bed rock occurs at a depth greater than 3 feet, but occasionally it is encountered within the third foot. The soil is largely residual, being mainly the weathered product of red Medina shale, but the surface has been modified to some extent by an admixture of glacial material. The type is marked by nearly level areas, the surface of which is thickly strewn with large granitic bowlders. The greater part of it is devoted to pasture and woodlots. It is best used for grass, although small yields of corn and wheat can be obtained where cultivation is practicable. It is adapted to bush berries, but not to tree fruits.

Sioux clay.—The soil is a black, dark-brown, or sometimes yellowish-brown clay loam or clay about 18 inches deep. The subsoil consists of a grayish-brown or grayish-yellow clay of stiff, tenacious, waxy texture. The type occupies river bottoms, the lower and flatter areas having the characteristics of the gumbo found in the Red River Valley. It is an excellent soil for small grain, wheat sometimes yielding

as much as 40 bushels per acre. Oats and flax also do remarkably well. The lighter areas are suitable for certain of the heavy truck crops.

Caneadea clay.—The soil is gray to drab silty clay with an average depth of 6 inches. The subsoil is a dense clay, drab to brown in color. The type is very difficult to cultivate and best adapted to the production of hay and for permanent pasture in connection with dairying and stock raising.

BLACK CLAY PHASE.

In the glacial and river terrace province only a very limited area has been shown to be occupied by the black clay phase of the clay group. So far this phase has been mapped only in New York and Vermont.

TABLE LXIV.—*Area and distribution of the black clay.*

Name of soil.	State and area.[1]	Acres.
Vergennes black clay	N. Y. 14; Vt. 1	4,224

[1] For key to numbers in this column, see p. 253.

Vergennes black clay.—The soil consists of a black loamy clay from 6 to 15 inches deep. It contains a high percentage of organic matter and is very tenacious and sticky when wet, but is granular and friable when dry. The subsoil is a heavy, tenacious drab clay, somewhat plastic in certain areas. The soil is more often underlain at 24 inches by a stiff, heavy clay similar to the subsoil of the Vergennes clay. The surface is usually flat or basinlike, and artificial drainage is necessary to secure the best yields. This is a strong and productive soil, giving large yields of corn and hay, especially when well drained.

STONY CLAY PHASE.

TABLE LXV.—*Area and distribution of the stony clay.*

Name of soil.	State and area.[1]	Acres.
Dunkirk stony clay	N. Y. 1, 5, 12	40,064

[1] For key to numbers in this column, see p. 253.

Dunkirk stony clay.—The soil, which has an average depth of 8 inches, is a compact yellow silty clay loam containing from 10 to 20 per cent of small rounded or angular stones. The subsoil is a brown, yellowish-brown, or mottled stiff clay, which becomes very sticky

and plastic when wet. The stone content of the subsoil is greater than that of the soil. The type occurs in steeply to gently sloping areas characterized by a series of parallel ridges and gullies. At the maximum elevation the surface is rather flat and the soil deeper. Though there is usually sufficient surface drainage the underdrainage is retarded by the very compact nature of the subsoil, so that ditching and tiling are necessary. Wheat and grass are profitably grown, the former averaging 20 or more bushels to the acre and the latter from 1½ to 3 tons of hay. The soil should be used for wheat, hay, and such other forage and ensilage crops as may be needed for dairying. The soil is also very well adapted to late crops of apples and pears. It is one of the best grape soils, producing rather large yields of sweet grapes which keep well and ship well.

SILTY CLAY PHASE.

Only one type of the silty variant of the clay group has been encountered in the soil survey. It had a somewhat important development in the one area in which it was mapped, and further work in the northeastern part of this province will doubtless increase its area.

TABLE LXVI.—*Area and distribution of the silty clay.*

Name of soil.	State and area.[1]	Acres.
Orono silty clay	Me. 2	83,200

[1] For key to number in this column, see p. 253.

Orono silty clay.—The type consists of an ashy-gray silty clay, underlain by the same material, several feet deep. When dry it is darker colored, often a dark bluish gray, and becomes more sticky and plastic. It is free from stones and gravel. The surface is level or very gently undulating and both surface drainage and subdrainage are efficient. The native tree growth was composed of white birch and alder, but a large proportion of the type is cleared and under cultivation. It is an excellent grass and grain soil and is extensively used for general farm crops, including potatoes, but must be underdrained to secure the best results.

MISCELLANEOUS MATERIALS.

The miscellaneous group consists of material which either has no present agricultural value or which requires very extensive and expensive reclamation work to adapt it to crops of any kind.

TABLE LXVII.—*Area and distribution of miscellaneous materials.*

Kind of material.	State and area.[1]	Acres.
Muck	Ill. 11; Ind. 4, 5, 6, 10; Ia. 1; Me. 1; Mich. 1, 2, 3, 4, 5, 6, 7, 8, 10; Minn. 2; N. Y. 1, 3, 5, 7, 8, 10, 11, 14; N. D. 4; Ohio 3; Vt. 1; Wis. 2, 3, 4, 5, 7.	604,842
Swamp	Ind. 7; Mich. 7, 8; N. Y. 3, 11, 13; R. I. 1; Vt. 1	48,256
Peat	Ill. 10; Ind. 1, 3, 7; Minn. 1, 3; N. Y. 2; Ohio 10	36,288
Dunesand	Mich. 1, 4; Minn. 6; N. D. 8; R. I. 1; Wis. 5	24,186
Tidal marsh	R. I. 1	4,224
Marsh	Mich. 4; N. Y. 14	3,584
Coastal beaches	R. I. 1	2,048

[1] For key to numbers in this column, see p. 253.

Muck.—This type consists of black, more or less thoroughly decomposed vegetable mold, from 1 foot to 3 feet or more in depth, occupying low, damp places, with little or no natural drainage. Muck may be considered an advanced stage of Peat, brought about by the more complete decomposition of the vegetable fiber and the addition of mineral matter through deposition by water or wind. The resulting soil is finer in texture and has a closer structure than Peat. When drained Muck is very productive. It should be used for cabbage, onions, celery, peppermint, and other special crops.

Swamp.—This term is used to designate areas covered with standing water for much or all of the time. Variations in texture and in organic matter content may and do occur. Swamp frequently occupies areas which are inaccessible, so that detailed mapping is impracticable. The native vegetable growth consists of water-loving grasses, shrubs, and trees. Many areas of Swamp are drainable, and when this is properly accomplished it not infrequently becomes a soil of high agricultural value.

Peat.—This is composed almost entirely of vegetable matter, consisting of the roots, stalks, leaves of water-loving trees, plants, and mosses in various stages of decomposition. It occurs as turf or bog, usually in low situations, and always more or less saturated with water. Owing to its coarse texture and undecomposed condition of the organic matter the Peat is generally of lower agricultural value than Muck.

Dunesand.—The Dunesand consists of loose, incoherent sand, forming hillocks, rounded hills, or ridges of various heights. Areas of this character are found along the shores of lakes, rivers, and oceans, and in deserts. They are usually of no agricultural value on account of their irregular surface, the loose, open nature of the material, and its consequent low water-holding capacity. The dunes are frequently unstable and drift from place to place. The control of these sands by the use of wind-breaks and binding grasses is frequently necessary

for the protection of adjoining agricultural lands. In certain regions, when leveled and placed under irrigation, the Dunesand is adapted to the production of truck crops and small fruits.

Tidal marsh.—The material varies from dark oozy sediments, interspersed with coarse marsh grass roots, to a yellowish or dark colored clay, resting at depths varying from 2 to 4 feet upon a still heavier, lighter colored clay. Calcareous nodules are sometimes present. Areas of this description occur extensively along seacoast and along large streams subject to tidal overflow. The vegetation consists of salt grass, which affords poor pasturage. The areas must be diked and drained before reclamation is possible, but when so reclaimed and the excess of salt removed, they make an exceedingly productive soil, especially for corn, cabbage, onions, potatoes, and hay.

Marsh.—This term is used to designate low, wet, treeless areas, usually covered by standing water and supporting a growth of coarse grasses and rushes. These marsh areas occur around the borders of fresh-water lakes and the lower courses of streams. They can seldom be drained without diking and pumping. When this is done the soil is usually productive.

Coastal beach.—This is a light-gray or white fine to coarse textured, loose, incoherent sand 3 feet or more in depth, containing varying amounts of shell fragments. It occurs as beaches, narrow ridges, and islands along the seacoast, and its surface varies from smooth to irregular and duny. At the higher elevations it is modified by wind action. It is not adapted to agricultural purposes.

SUMMARY.

The soils of the Glacial Lake and River Terrace province have been derived from materials washed from the Glacial and Loessial province assorted and deposited by rivers and by wave action in the old glacial lakes. The total area of the province is estimated to be about one-tenth the area of the Glacial and Loessial province, but it has many more soil types, which makes possible a much greater diversity of crop interests and gives opportunity for a high degree of specialization. There have been surveyed and mapped 7,586,286 acres, or about one-sixth of the province. The areas have been so distributed that a fair idea has been obtained of the soil resources of the region. The soils are not so fully weathered nor has the drainage been so fully established as in soils of upland provinces, and this makes possible the cropping of coarser textured soils than would be advisable on the uplands. It also involves much more extensive drainage operations to bring out the highest efficiency of the soil.

There have been surveyed 502,112 acres of sand (including gravel, gravelly sand, and coarse sand), which is 6.6 per cent of the area sur-

veyed in the province. The soils of this group are adapted, under intensive methods of culture, to the production of the very early vegetables, which, under climatic conditions of the province, begin to mature the latter part of June. They are also adapted to melons and early fruits.

Of the fine sands there have been mapped 425,150 acres, or 5.6 per cent of the area surveyed. The soils of this group are adapted to the same products as the sands, though the crops mature somewhat later and the yields are somewhat larger.

The sandy loams (including gravelly sandy loam, stony sandy loam, and coarse sandy loam) cover 947,384 acres, or 12.5 per cent of the area surveyed. Under normal drainage conditions these soils produce vegetables and fruits for a still later market and are adapted to the lightest type of general agriculture.

The fine sandy loams, covering 860,494 acres, or 11.3 per cent of the area surveyed, produce vegetables still somewhat later and support a somewhat heavier type of farming.

The loams (including stony loams, gravelly loams, and shale loams), covering 1,725,708 acres, or 22.8 per cent of the area surveyed, require a heavy farm equipment and are admirably adapted to canning crops and vegetables for the winter markets, late fruits, and light types of dairying, in which pasture is used as an important source of feed.

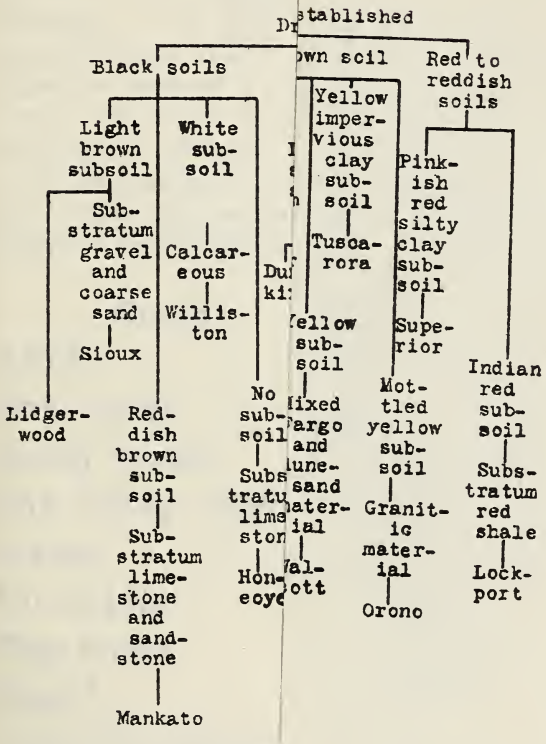
One surprising thing about this province is the relatively small area occupied by the silt loams, aggregating 376,990 acres, or 4.9 per cent of the area surveyed. It is surprising because of the predominance of silt soils in the Glacial and Loessial province. The group is so poorly represented that its true position can hardly be realized.

The clay loams, covering 783,360 acres, or 10.3 per cent of the area surveyed, and the clays (including stony clay, silty clay, and black clay), covering 1,241,660 acres, or 16.4 per cent of the area surveyed, require the very heaviest type of farm equipment and are particularly adapted to the most intensive type of dairy farming, where feeding is done throughout the year with a minimum use of pasture. Vegetables and fruits when grown are late and stored for the winter markets.

The miscellaneous materials mapped cover 723,428 acres, or 9.5 per cent of the area surveyed, and if of any possible agricultural use require expensive reclamation works to put them in condition for such use.

In all groups drainage factors enter, greatly affecting the present agricultural value of the soils.

The classification of the soils of this province is shown in the diagram, figure 10, facing page 168.


Black soils
Light brown subsoil
Sub-stratum gravel and coarse sand
Sioux
Lidger-wood
White sub-soil
Calcar-eous
Willis-ton
Red-dish brown sub-soil
Sub-stratum lime-stone and sand-stone
Mankato
No sub-soil
Subs tratu lime ston
Hon- eoye
Yellow imper-vious clay sub-soil
Tusca-rora
Yellow sub-soil
Mixed argo and une- sand ater- ial
Val- ott
Red to reddish soils
Pink-ish red silty clay sub-soil
Supe-rior
Mot-tled yellow sub-soil
Granit-ic mater-ial
Orono
Indian red sub-soil
Subs-tratum red shale
Lock-port

Key to the soils of the Glacial Lake and River Terrace Province.

- Drainage well established
  - Black soils
    - Light brown subsoil
      - Substratum gravel and coarse sand
        - Sioux
      - Substratum limestone and sandstone
        - Mankato
      - Substratum lime-stone
        - Honeoye
    - White subsoil
      - Calcareous
        - Williston
      - No subsoil
        - Substratum limestone
          - Honeoye
  - Gray to brown soils
    - Yellow subsoils
      - Limestone shale and sandstone material
        - Dunkirk
        - Substratum sand and gravel
          - Chenango
      - Schistose and slaty rock material
        - Hoosic
      - Slate and some limestone material
        - Hudson
      - Coarse grained granitic till
        - Merrimac
      - Dark gray soil
        - Gray subsoil
          - Mixed glacial material
            - Calcareous
              - Substratum quick sand
                - Bearden
    - Reddish brown subsoil
      - Substratum limestone and sandstone
        - Mankato
    - Shale and sandstone material mixed
      - Friable subsoil
        - Caneadea
    - Limestone material
      - Fishkill
    - Diabase and fine grained crystalline and triassic sandstone material
      - Hartford
      - Substratum red triassic sandstone
        - Manchester
      - Micaceous
        - Podunk
    - Clyde
- Drainage poorly established
  - Black soil
    - Mottled drab and yellow subsoil
      - Calcareous
        - Subsoil stiff and plastic
          - Fargo
        - Subsoil sandy and very friable
          - Substratum gravel
            - Benoit
          - Subsoil silty and moderately friable
            - Fragments of stone conspicuous
              - Washburn
      - Diabase and fine grained crystalline and triassic sandstone material
        - Stiff impervious subsoil
          - Suffield
        - Subsoil friable
          - Substratum very friable yellow loam
            - Tonowanda
        - Pinkish red clay subsoil
          - Poygan
  - Yellow soil
    - Drab subsoil
      - Impervious clay
        - Elmwood
      - Black subsoil
        - Substratum sand and peat
          - Newton
    - Yellow subsoil
      - Humocky surface
        - Chapman
  - Gray to brown soil
    - Drab subsoil
      - Iron hardpan
        - Saugatuck
      - Gray subsoil
        - Substratum mottled olive and yellow from soft slate
          - Livingston
    - White subsoil
      - Substratum marl
        - Warner
      - Drab subsoil
        - Extremely stiff and tenacious
          - Vergennes
    - Yellow impervious clay subsoil
      - Tuscarora
      - Yellow subsoil
        - Mixed Fargo and dune-sand material
          - Walcott
  - Red to reddish soils
    - Pinkish red silty clay subsoil
      - Superior
      - Mottled yellow subsoil
        - Granitic material
          - Orono
    - Indian red subsoil
      - Substratum red shale
        - Lockport

SOILS OF THE LIMESTONE VALLEYS AND UPLAND PROVINCE.

The soils of this province are derived directly and mainly from limestone rock, of which there are two prevailing types, the Trenton limestone, a very pure form of lime carbonate, which upon disintegration gives rise to the Hagerstown series, in which the most important member is a loam, and the St. Louis limestone, a highly cherty rock, which upon weathering results in a dominant agricultural type of silt loam. No sand or fine sand has been encountered in the province and very little sandy loam or fine sandy loam. Figure 11 gives diagrammatically the relative extent of the important groups of soils in this province.

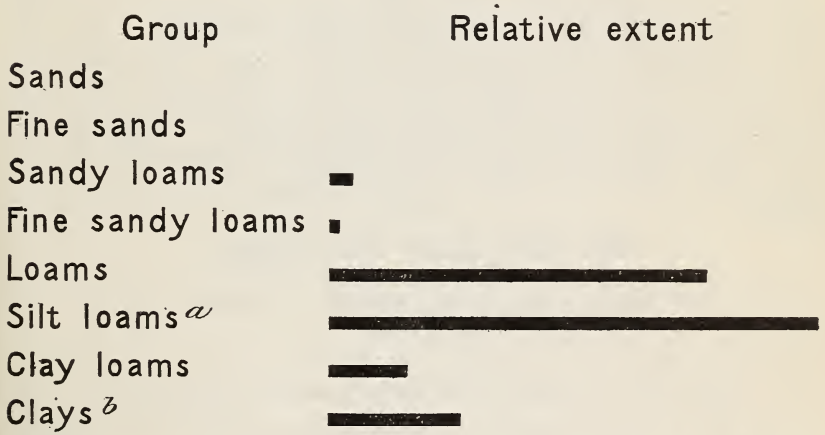


FIG. 11.—Diagram showing the relative extent of the important groups of soils in the Limestone Valleys and Upland province. a. Including the stony silt loam phase. b. Including the stony clay phase.

The two important groups are the loams, mainly the Hagerstown loam, and the silt loams, mainly the Clarksville silt loam, with smaller areas of clay loams and clays. These necessitate a type of heavy farming requiring for the highest efficiency of the soil a heavy equipment of teams, implements, and farm buildings.

The subordinate soils, including the stony loams and gravelly sandy loams, constitute over 43 per cent of the entire area, and mark the areas where the rock has been more resistant to weathering agencies or where erosion has kept pace with rock decay. Such

soils have at present no very important place in the agricultural development of the country, and their chief use should be for forestry.

SANDY LOAM GROUP.

Up to the present time but one sandy loam soil has been mapped in the Limestone Valleys and Uplands province, though there are wide areas carrying more or less sand in which the interstitial material has a sandy loam texture. As stated above, these stony soils, on account of their low agricultural value, have been thrown into the group of subordinate soils.

TABLE LXVIII.—*Area and distribution of the Hagerstown sandy loam.*

Name of soil.	State and area.[1]	Acres.
Hagerstown sandy loam	Ala. 16; Pa. 5; Tenn. 11; Va. 1, 3; W. Va. 1	74,246

[1] For key to numbers in this column, see p. 253.

Hagerstown sandy loam.—The soil is a fine sandy loam, about 12 inches deep, of a gray to yellowish or light-brown color. The subsoil is a yellow-red clay grading into stiff red clay. The type occupies some of the higher ridges of the valley and has good drainage. The soil should be used for early fruit, particularly peaches, for medium late truck crops, and for a light type of general farming, in which light yields and early crops of wheat, corn, and hay are secured.

THE FINE SANDY LOAM GROUP.

In the fine sandy loam group also the Limestone Valleys and Uplands province is poorly represented.

TABLE LXIX.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Clarksville fine sandy loam	Ala. 19	1,856
Colbert fine sandy loam	Ala. 9	960

[1] For key to numbers in this column, see p. 253.

Clarksville fine sandy loam.—The soil, which ranges in depth from 6 to 15 inches, is a gray or light-orange colored fine sandy loam of loose texture. The subsoil, to a depth of more than 3 feet, is a red sandy clay, being more sandy in the upper portion. The surface features are not very uniform, varying from low, rolling hills to narrow ridges. The type has been formed from remnants of sandy layers of the Lafayette formation, mixed with the clay of the underlying

limestone. Surface drainage is complete, but the subsoil is capable of retaining a large quantity of moisture. The soil is excellent for peaches and, where well drained, for cotton and other general farm crops.

Colbert fine sandy loam.—The type consists of a gray to brownish fine sandy loam, 6 or 8 inches deep, underlain by a reddish heavy fine sandy loam or sandy clay. The topography is gently rolling to slightly undulating and the type is derived from interbedded sandstone and limestone along the line of contact of the Tennessee Valley and the Appalachian Plateau. It is a good type of intermediate value between the red limestone soils and the gray mountain lands of the Coal Measures.

THE LOAM GROUP.

The loam group is next to the most extensive group of soils in the province, approximately 1,500,000 acres having been surveyed up to the present time. Most of this area is made up of the Hagerstown loam.

TABLE LXX.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Hagerstown loam	Ala. 12, 13, 16, 17, 19; Ky. 2, 3, 4; N. Y. 9; Pa. 1, 2, 3, 4, 6, 7, 9; Tenn. 2, 3, 5, 7, 11; Va. 1, 3, 7, 9.	1,211,910
Clarksville loam	Ala. 6, 9, 27; Tenn. 4	129,024
Decatur loam	Ala. 3, 4, 6, 27; Tenn. 10	70,720
Conestoga loam	Pa. 6, 9	52,344
Athol loam	Pa. 2	3,968

[1] For key to numbers in this column, see p. 253.

Hagerstown loam.—The type is composed of a brown or yellowish loam soil 12 inches deep, underlain by a subsoil of yellow clay loam to a depth of 24 inches, which in turn is underlain by a stiff, yellowish-red clay. The type occupies rolling land and is derived from the weathering of pure massive limestone. This is the typical corn soil of central Pennsylvania, Maryland, and the Shenandoah Valley of Virginia. It is one of the best types for general farming land in the Eastern States and produces corn, tobacco, wheat, and grass as the principal crops. It requires a heavy farm equipment to bring out its highest efficiency. It is well adapted to fruit, especially to commercial orchards of fall and winter apples. It produces large yields of vegetables of fine quality, especially for canning.

Clarksville loam.—The soil is a light-brown, yellow, or gray silty loam 8 inches in depth. A few cherty and siliceous limestone fragments may occur. The subsoil is a heavy yellow silty loam grading

into reddish-yellow silty loam, which at about 36 inches becomes a dark-red silty clay loam or clay. It occupies rolling to hilly valley areas and is inclined to be droughty. It produces only fair yields of cotton and corn.

Decatur loam.—The soil is a brown heavy fine sandy loam to dark-brown loam 4 to 10 inches deep. The subsoil is a light-red or yellowish-red clay grading into a stiff, sticky, dark-red clay. Occasional gravel areas occur near stream courses. The subsoil is everywhere residual from limestone, while the soil is largely a sedimentary deposit reworked by water, though in some areas it represents a wash from mountain slopes and in other places material from fine-grained sandstone or fine silicious strata of the limestone. It occupies rolling uplands in the vicinity of the larger streams and the drainage is good. The type does not suffer from erosion or drought. It is adapted to cotton and corn, small fruits, tree fruits, and heavy truck crops.

Conestoga loam.—The type consists of a brown loam, about 12 inches deep, underlain by a light clay loam to a depth of 30 inches, which grades into decomposed schist. It occupies rolling valley lands and is derived from the decomposition of schistose limestone. It has a greasy or soapy feel when rubbed between the fingers. It is a difficult soil to handle and requires a heavy farm equipment. It is well adapted to corn, wheat, and grass, and is only slightly inferior to the Hagerstown loam, with which it is associated.

Athol loam.—The surface soil consists of brownish-red to light-brown medium loam to heavy silty loam 10 inches deep. The subsoil is reddish-brown, yellowish-red or yellow clay loam or sandy clay. The type has some of the characteristics of both the Hagerstown silt loam and Penn loam, but is recognized as a distinct type. It is derived from a breccia known as Potomac marble, which is composed of waterworn fragments of limestone, Cambrian sandstone, and Triassic sandstone embedded in a matrix of Triassic material. Some outcrops of the parent rock occur. The surface is gently to moderately rolling. This is a good general farming soil. Wheat yields from 12 to 28 bushels; corn, 30 to 50 bushels; oats, about 38 bushels; and timothy, 1 to 1½ tons per acre.

GRAVELLY LOAM PHASE.

TABLE LXXI.—*Area and distribution of the gravelly loam.*

Name of soil.	State and area.[1]	Acres.
Clarksville gravelly loam	Ala. 12	9,984

[1] For key to number in this column, see p. 253.

Clarksville gravelly loam.—The soil is a gray to yellowish-gray silt loam, 12 inches deep, carrying a small quantity of the medium and fine grades of sand, and a little coarse sand. The subsoil is a grayish to a reddish-yellow heavy silty loam which quickly grades into a silty clay. From 10 to 25 per cent of small angular chert fragments is found on the surface and smaller quantities appear throughout the soil mass. The surface is undulating to gently rolling and cultivation is easy. The type should be used for rather light general farming, with cotton or corn as the principal crop, and for stock raising.

THE SILT LOAM GROUP.

Silt loam is the predominant texture of the soils of the Limestone Valleys and Uplands province. Table LXXII shows seven distinct types of this texture besides a stony type in which the fine earth is silty.

TABLE LXXII.—*Area and distribution of the silt loams.*

Name of soil.	State and area.[1]	Acres.
Clarksville silt loam	Ala. 16, 19; Ark. 2; Ky. 6; Mo. 4, 5, 6, 9, 12; Tenn. 1, 3, 7, 9, 10, 12.	1,599,938
Hagerstown silt loam	Pa. 3, 5; Tenn. 1, 12; Va. 9	142,976
Decatur silt loam	Ala. 9; Mo. 3; Tenn. 3, 12	72,128
Colbert silt loam	Ala. 9	33,088
Baxter silt loam	Mo. 4	25,088
Guthrie silt loam	Ala. 9, 27; Mo. 3; Tenn. 1, 3, 10, 12	8,896
Locust silt loam	Ala. 12	4,992

[1] For key to numbers in this column, see p. 253.

Clarksville silt loam.—The type is made up of a surface soil of light-gray silt loam, 8 inches deep, and a subsoil of yellowish compact silt loam, gradually changing to silty clay with depth. The color of the lower subsoil often changes to reddish-yellow or red. The surface is level or gently rolling, the larger and more level areas being generally poorly drained. The type is known locally as "Barrens" or "Flatwoods" and is largely forested with oaks. It is droughty and not a strong soil, but with good treatment fair yields of the staple crops can be produced. In Tennessee and Kentucky this soil produces an excellent grade of export tobacco. Special crops, such as strawberries and cantaloupes and some vegetables, are grown successfully.

Hagerstown silt loam.—The soil is a gray, occasionally brownish-gray, silt loam, containing a low percentage of fine textured sand and on the hillsides a percentage of small weathered, calcareous shale

fragments. The subsoil is a yellowish to reddish-yellow clay loam passing, at about 24 inches, into a stiff, heavy, yellowish-red clay, which extends 3 feet or more. The subsoil may contain some disintegrating fragments of shale rock. The topography is more or less rolling. This is an excellent heavy general farming soil, producing good crops of corn, wheat, and hay. Late fruits and vegetables are also grown.

Decatur silt loam.—The type consists of a reddish-brown silty loam, 6 to 12 inches deep, underlain by a reddish-brown silt loam grading into a dark-red silty clay. Usually the material is free from stones, but some chert occasionally is found in both the soil and subsoil. The type is usually associated with the Clarksville silt loam and occurs in level to gently undulating areas marked here and there by sink holes. Originally it was forested with oak, black and sweet gum, chestnut, and poplar. Corn, wheat, and cotton are the principal crops. This is an excellent soil for cantaloupes and for late strawberries and vegetables.

Colbert silt loam.—The soil of this type is a silt loam, with a depth of about 8 inches; the subsoil a heavier, more compact material of a grayish-yellow to reddish-yellow color. A small amount of sandstone and shale and sometimes limestone fragments occur in soil and subsoil. The type is found in northwestern Alabama along the line of contact between the Tennessee Valley and the Appalachian Plateau. It is derived from the weathering of sandstones interstratified with limestone. The topography is generally undulating to rolling. The crop value is higher than that of the Dekalb soils of contiguous mountain areas.

Baxter silt loam.—This is a gray, pale-yellow to reddish-brown silt loam, ranging from moderately stony to stone free, the stone consisting of chert in nodules, irregularly shaped fragments, and slabs. The chert varies in structure from banded amorphous and oolitic to cellular. The fragments vary from the size of small gravel to masses of a ton in weight. In Cooper County, Mo., the large masses are absent. The subsoil is a yellowish-brown to dark reddish-brown clay to silty clay, usually not so stony as the soil, though the stones occurring in it are of the same kind as those in the soil.

The layer of soil material is relatively thin. Rock outcrops are frequent. This soil is derived from a series of limestones and magnesium limestones, with occasional thin beds of bluish, grayish, or yellowish calcareous shales. The limestones and magnesian limestones occur in two phases. One is a dark-gray, fine-grained, crystalline rock, containing beds, nodules, and lenses of chert. The other

is a gray, cream to white, soft amorphous, earthy limestone, locally called "cotton rock."

The soil differs from the Clarksville stony loam in being less stony and usually grayer in color. Its subsoil is unlike the Clarksville in being less stony, either more yellowish or a darker reddish brown in color, and in having a higher percentage of clay. The layer of soil material is thinner than that of the Clarksville silt loam.

Guthrie silt loam.—The type consists of 8 to 12 inches of gray or drab silt loam, underlain by compact drab to yellow silt loam. It occupies depressions or sinks in the limestone region and is composed of material washed in from surrounding slopes. It is poorly drained and is locally known as "crawfish land." It is of little value for agriculture.

Locust silt loam.—The soil consists of a grayish-yellow silt loam, 14 inches deep. The subsoil is a yellow silty clay, which at a depth of from 5 to 7 feet often grades into a stratified layer of angular chert gravel 6 to 8 inches thick. The surface is slightly undulating and slopes toward the streams. The type has some of the characteristics of an alluvial soil, but the question of origin is yet in doubt. Cotton, corn, and hay are profitably grown. Stock raising could be made a profitable industry.

STONY SILT LOAM PHASE.

TABLE LXXIII.—*Area and distribution of the stony silt loam.*

Name of soil.	State and area.[1]	Acres.
Decatur stony silt loam	Mo. 3	15,872

[1] For key to number in this column, see p. 253.

Decatur stony silt loam.—The soil is a dull red loam from 6 to 12 inches deep. The subsoil is a red loamy clay. The soil contains from 10 to 20 per cent and the subsoil from 20 to 50 per cent of angular chert fragments. It is a friable and easily worked soil except for the stones. It has a rolling topography, with good drainage. The type is especially suited to wheat, while grasses, corn, and fruit do well.

THE CLAY LOAM GROUP.

On a basis of the area in this province so far covered by the soil survey it would appear that the soils of clay loam texture are rela-

tively of small extent. Table LXXIV shows the types so far established:

TABLE LXXIV.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Decatur clay loam	Ala. 3, 6, 12, 17, 27; Tenn. 1, 4; Va. 9	128,000
Hagerstown clay loam	Pa. 2, 3, 5, 6; Va. 9	97,096
Brooke clay loam	W. Va. 2, 3, 4, 6	41,664
Clarksville clay loam	Ky. 6; Tenn. 9	36,868
Murrill clay loam	Va. 3	15,720
Fort Payne clay loam	Tenn. 5	9,536
Colbert clay loam	Ala. 9	3,136

[1] For key to numbers in this column, see p. 253.

Decatur clay loam.—The soil consists of a brown to reddish-brown heavy but friable clay loam 8 to 12 inches deep. The subsoil which extends to a depth of several feet is a reddish-brown to red clay, for the most part free of stone. Where the soil is deepest the subsoil usually grades through a brown clay loam into a clay at an average depth of about 18 inches. Here and there over the type are local outcrops of limestone, but these are not numerous enough to interfere seriously with cultivation. The type is generally rolling in topography. Nearly all of it is under cultivation and producing good crops of corn, wheat, oats, cowpeas, and sorghum. Apples thrive when given proper care.

Hagerstown clay loam.—The soil is a heavy reddish loam or silty loam 24 inches deep. The subsoil consists of a tenacious red clay. The type occupies rolling valley land. This is recognized as one of the strongest soils for general agricultural purposes and is highly esteemed for its large crops of wheat and corn. It is a heavy soil to handle and requires a heavy farm equipment. It is an excellent soil for an intensive form of dairy farming.

Brooke clay loam.—The soil is a brown or dark-brown heavy loam or clay loam ranging in depth from 6 to 10 inches, with an average depth of 8 inches. The subsoil is a light-brown clay and changes gradually to a slightly yellowish, heavier clay at a depth of about 20 inches. Below this to a depth of 3 feet or more the texture remains a heavy clay, but the color continues to get lighter, and sometimes at a depth of 3 or 4 feet it becomes a gray or drab. Scattered over the fields and disseminated through both soil and subsoil are small fragments of gray or bluish-colored limestone and calcareous shale, and these rocks can often be seen outcropping in road cuts. On narrow ridges, where the surface soil has been removed by erosion,

the rock fragments are more noticeable and the surface material is apt to be clay. The type is derived from the disintegration of limestone rock and calcareous shales, and where well developed is gently rolling to moderately hilly in topography. A large percentage of it is under cultivation and it is recognized as a valuable soil for general farming. Corn, oats, wheat, timothy, clover, and bluegrass are the principal crops. Apples, cherries, plums, raspberries, strawberries, and garden vegetables are grown for home use and to some extent for market. Bluegrass comes in as the timothy thins out, and this makes the land very valuable for grazing purposes. Very few potatoes are grown upon this soil, as it is considered too heavy.

Clarksville clay loam.—The type consists of a brown to reddish-brown silty loam, 8 inches deep, underlain by a heavy red silty clay loam to a depth of 3 feet or more, the clay content increasing at lower depths. The type occupies gently undulating country and is usually well drained. It is a deep residual soil, strong and fertile, and considered the best general farm land of the localities where it occurs and of the Clarksville series. Tobacco of the export variety produces a heavy yield, but not a superior leaf. It is adapted to corn, wheat, and hay and dairy farming.

Murrill clay loam.—The type is composed of a yellowish-brown clay loam soil, 10 inches deep, overlying a subsoil of yellow clay loam, which increases in clay content in lower depths. Both soil and subsoil often contain small fragments of shale and chert. The type is derived from the weathering of shale and cherty limestone and occupies rolling lands. It produces good crops of wheat, corn, grass, dark manufacturing tobacco, and apples.

Fort Payne clay loam.—The soil is a compact loam to silty loam, with an average depth of 10 inches and an ashy appearance and feel. The color ranges from gray to light yellow. The subsoil is a heavy yellow clay loam, grading quickly into stiff, sticky, impervious yellow clay, which in the lower depths is often mottled with red. The type occupies high hilly to gently rolling areas. It is a residual soil, derived from the weathering of a series of rocks, consisting of sandy to argillaceous calcareous shale and shaly limestone. It is difficult to work and when dry becomes very hard. It is best suited to grasses and pasturage.

Colbert clay loam.—The surface soil consists of a gray heavy silty loam or clay loam 6 inches deep. The subsoil is a mottled gray or grayish-yellow clay. The topography varies from flat to undulating and the natural drainage is rather deficient. When well drained it is a good soil for the ordinary farm crops.

THE CLAY GROUP.

Five types and one of the stony phase have so far been mapped in the clay group of this province.

TABLE LXXV.—*Area and distribution of the clays.*

Name of soil.	State and area.[1]	Acres.
Hagerstown clay	Ala. 13, 16; Ky. 2, 3, 4; Pa. 3, 6; Tenn. 5; Va. 1, 3; W. Va. 1.	354,074
Conestoga clay	Tenn. 5; Va. 1	64,128
Guthrie clay	Ala. 16, 19; Ark. 5; Ky. 2; Tenn. 9	53,608
Decatur clay	Tenn. 4	15,040
Colbert clay	Ala. 9	1,408

[1] For key to numbers in this column, see p. 253.

Hagerstown clay.—The type consists of a heavy brown to reddish-brown loam or clay loam, 12 inches deep, underlain by a stiff, tenacious reddish-yellow or red clay. It occupies rolling valley land and is derived from weathering of pure massive limestone. This is recognized as a very strong soil for general agriculture. It is a heavy soil to handle and requires the heaviest farm equipment. It is adapted particularly to hay and forage crops and the most intensive form of dairying.

Conestoga clay.—The type consists of a yellowish to dark-brown clay loam, about 7 inches deep, underlain by a yellow to reddish-yellow tenacious clay, usually not exceeding a depth of 24 inches. On ridges the bed rock is usually found at an average depth of 10 inches. The type occupies the lower and gentler rolling portions of the valleys. The higher areas are well drained. This soil is derived from schistose limestone. Wheat and grass are the principal crops grown.

Guthrie clay.—The type is composed of a light-gray or grayish-white fine silt loam soil, with a depth of 7 inches, underlain by a subsoil of heavy silty clay, plastic and impervious. The subsoil varies in color from gray to drab, mottled with yellow iron stains. The type occupies low, flat areas on the uplands. On account of its low, wet situation it is of little agricultural value unless artificially drained. In favorable seasons some corn and tobacco are grown. The type is largely covered by hickory, sweet gum, and oak, and the land is generally referred to as "crawfishy."

Decatur clay.—The type consists of 4 to 6 inches of a reddish-brown clay loam or friable clay, underlain by a very stiff red clay. At various depths below 18 inches massive limestone rock is encountered. The areas are moderately rolling to hilly and broken, with

numerous sink holes and ledges and large rock fragments on the surface. The drainage is good. Cedar timber thrives in the more stony locations. Little of this type is in cultivation, owing to large quantity of stone on surface, but it is an excellent upland soil for general farming, where no stones are present. Clover and bluegrass make excellent sod, and the type should be devoted to grasses and stock raising.

Colbert clay.—The soil is a dark-gray heavy, sticky clay about 6 inches deep; the subsoil, a heavy mottled yellow and gray clay. The surface is gently rolling, and the drainage is good. This is a difficult soil to handle, but when properly managed it produces good crops of corn and alfalfa.

STONY CLAY PHASE.

The stony clay phase of the clay group in the limestone valleys and upland province is represented by a single type. This has been encountered only in the southern part of the province where it is of relatively small extent and low agricultural value. Table LXXVI shows its distribution.

TABLE LXXVI.—*Area and distribution of the stony clay.*

Name of soil.	State and area.[1]	Acres.
Hagerstown stony clay	Ala. 4, 12; Ky. 2; Tenn. 4	55,808

[1] For key to numbers in this column, see p. 253.

Hagerstown stony clay.—The type consists of about 8 inches of brown to yellow clay loam, or clay, underlain by yellow sticky clay. Usually limestone fragments are abundant in both soil and subsoil, and massive ledges of hard, bluish-gray limestone frequently outcrop. The surface is usually rough, stony, and hilly, consisting of ridges and valley slopes. The soil is naturally quite productive, but owing to the large quantity of rock fragments and rock outcrop very little of it is under cultivation. Fair yields of corn, wheat, cotton, and forage crops are secured on the less stony areas.

SOILS OF SUBORDINATE VALUE.

A very considerable area mapped in the province has been included with the subordinate soils. A small area of this has a gravelly texture; the rest is stony. Of one type, the Clarksville stony loam, more than 2,700,000 acres has been mapped, while the Hagerstown stony loam covers something less than 500,000 acres.

GRAVELLY SANDY LOAM.

TABLE LXXVII.—*Area and distribution of the gravelly sandy loam.*

Name of soil.	State and area.[1]	Acres.
Clarksville gravelly sandy loam	Ala. 6, 27	17,024

[1] For key to numbers in this column, see p. 253.

Clarksville gravelly sandy loam.—The type consists of a light-brown, grayish or yellowish medium to fine sandy loam, 8 inches deep, which carries a large percentage of fine and coarse rounded quartz, sandstone, and chert fragments, underlain by a gritty, sandy, yellow clay, which becomes reddish and very heavy with depth. It occupies hilly areas, generally near stream courses. The drainage is so thorough that droughts are likely to be injurious. The subsoil is largely residual from a siliceous member of the limestone formation. When highly fertilized fair crops of cotton are secured.

STONY LOAMS.

TABLE LXXVIII.—*Area and distribution of the stony loams.*

Name of soil.	State and area.[1]	Acres.
Clarksville stony loam	Ala. 3, 4, 6, 9, 12, 13, 17, 19, 27; Ark. 2; Mo. 3, 4, 5, 6, 9, 12; Tenn. 1, 2, 3, 5, 7, 9, 10, 12.	2,723,540
Hagerstown stony loam	Ala. 16, 17; Pa. 1, 2, 3, 5, 8; Tenn. 1, 3, 4, 10, 11, 12; Va. 1, 3, 9.	412,398
Decatur stony loam	Ala. 6, 27; Tenn. 10	131,328
Frankstown stony loam	Pa. 5	2,048

[1] For key to numbers in this column, see p. 253.

Clarksville stony loam.—The type consists of a gray or light-yellow to brown silty loam soil, 6 inches in depth, overlying a yellowish-red to red silty clay or clay subsoil, extending to a depth of 3 feet or more. Both soil and subsoil contain 20 to 50 per cent of angular fragments of chert and siliceous limestone. The type occupies rough, broken country, with deep-cut, narrow valleys. It is derived from cherty siliceous limestones, and is thin and stony and of little agricultural value. At present it is largely covered with a thick second growth of oak timber. It produces apples and peaches of desirable quality, and the fruit industry has developed rather rapidly upon some areas in recent years. The main drawback to commercial orcharding is the difficulty of spraying and otherwise caring properly for the orchards upon areas of such rough topography.

Hagerstown stony loam.—The soil, which has an average depth of 8 inches, consists of a silty or fine sandy loam, usually brown in color,

but varying from light gray to yellowish. The subsoil is a yellow or yellowish-red clay loam, grading at an average depth of 24 inches into a stiff red clay which extends to considerable depth. Upon the surface and occupying a large part of the soil and the first few inches of the subsoil occurs a high percentage of angular chert fragments. The type is derived from the solution of impure limestones containing cherty layers, the insoluble materials being concentrated at the surface. The type occupies high ridges in the limestone valleys. The surface drainage is thorough, but with its close subsoil the type is retentive of moisture. The soil is particularly well adapted to fruit growing, and is especially well suited to the production of apples for the winter market, the main drawback being difficulty in giving orchards efficient care owing to the rough surface of many areas.

Decatur stony loam.—The soil consists of 6 to 10 inches of dark-brown silty loam, with varying texture. The subsoil is a dark-red or yellowish-red heavy clay loam, grading into a stiff plastic dark-red clay. From 10 to 60 per cent of the surface and soil mass is occupied by subangular and rounded sandstone, quartz, and quartzite gravel and stones. Some chert and siliceous limestone occur in localities, veins and strata of which may also occur in the subsoil. The type occupies the lower slopes of mountains and the tops and slopes of valley ridges. The surface is rather hilly and rough, which insures good drainage, though droughts are seldom injurious. This type consists largely of residual, material from the Knox dolomite forming the subsoil, while the soil appears to be transported material, for the most part colluvial, though waterworn stones and gravel occur in some localities. Except in the rougher and more stony areas, it is tillable and gives good yields of corn and cotton. Commercial peach orchards have been developed on it and apples and berries do well.

Frankstown stony loam.—The type consists of a gray silt loam 6 to 8 inches deep, underlain by a floury light-gray silt loam, which becomes yellow and more loamy with depth, until at 36 inches it grades into a yellow loam. Small calcareous rock and quartz fragments cover the surface in places. The soil and subsoil contain from 15 to 60 per cent of such fragments. Bed rock usually lies within 3 to 6 feet of the surface. The type occupies rather steep slopes and has excellent drainage. It is formed from the disintegration of water limes. The type is usually in cultivation and devoted to such farm crops as wheat, corn, and oats with fair success. It is, in general, deficient in organic matter and should be kept more in pasture, which would tend to increase the humus content and prevent washing and leaching.

MISCELLANEOUS MATERIALS.

Miscellaneous material in the Limestone valleys and Uplands province is confined to one kind, namely, Rough stony land, and of this but a relatively small area occurs.

TABLE LXXIX.—*Area and distribution of Rough stony land.*

Kind of material.	State and area.[1]	Acres.
Rough stony land	Mo. 3, 12; Tenn. 1, 3, 12	46,400

[1] For key to numbers in this column, see p. 253.

Rough stony land.—Under this heading have been classed areas so stony and broken as to be nonarable, although permitting timber growth and use for pasture. These areas frequently consist of steep mountain ridges, bluffs, or narrow strips extending through definite soil types. They differ from rock outcrop in that they support vegetation of economic value and from the stony loams in being nonarable.

SUMMARY.

No sand or fine sand has been mapped in this province, and it therefore offers no opportunity for commercial production of very early truck crops. Out of a total of 7,666,814 acres surveyed there has been mapped 74,246 acres, or 1.7 per cent of the area surveyed, of sandy loam, and 2,816 acres, or 0.1 per cent of the area surveyed, of fine sandy loam upon which medium late crops of vegetables and fruits can be produced and a light type of general farming carried on.

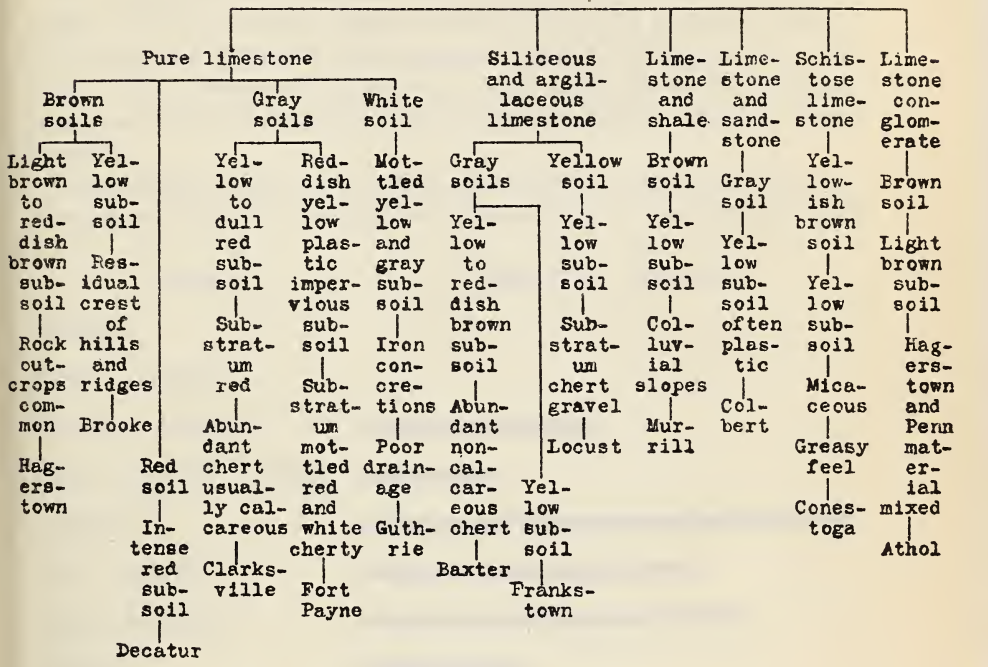
There are 1,477,950 acres, or 19.2 per cent of the area, mapped as loams, which require a heavy type of farm equipment for the production of large yields of general farm crops, especially corn, wheat, hay, and pasture grasses. The loams are also, as a class, adapted to late fruit crops, especially apples, and to canning crops.

There have been mapped 1,902,978 acres, or 24.8 per cent, of silt loam; 332,020 acres, or 4.3 per cent, of clay loam; and 544,066 acres, or 7.1 per cent, of clays, requiring the very heaviest farm equipment, and, especially in case of the clay loams and clays, adapted to the most intensive form of dairy farming. These groups are also adapted to certain varieties of fruit, especially to late winter apples.

There have been mapped 3,332,738 acres, or about 43 per cent of the area, of subordinate soils of low agricultural value.

The classification of the soils of this province is shown in the diagram, figure 12, facing page 182.

Key to the Soils of the Limestone Valleys and Uplands Province.



SOILS OF THE APPALACHIAN MOUNTAIN AND PLATEAU PROVINCE.

The Appalachian Mountains are made up of a number of parallel ranges and intervening valleys, which extend in a general northeast and southwest direction from southern New York to northern Alabama. The elevation ranges from about 1,500 to nearly 7,000 feet above sea level, the highest point being attained in western North Carolina.

Immediately west of the Appalachian Mountains, and usually separated from them by a valley, is a wide stretch of country known as

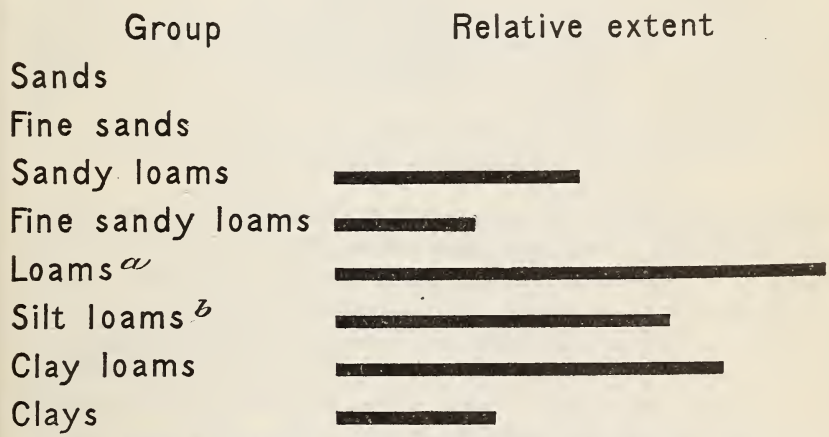


FIG. 13.—Diagram showing the relative extent of the important groups of soils in the Appalachian Mountain and Plateau province. a. Including the black loam and shale loam phases. b. Including the stony silt loam phase.

the Allegheny Plateau. In a broad way this plateau is carved out of a great block of sedimentary rocks tilted to the northwest from the mountains. It is crossed by numerous streams. As they run in deep channels (all the larger ones being from 200 to 1,000 feet in depth), the dissection of the plateau block is often minute.

The rocks of the eastern ranges of the Appalachian Mountains are igneous or metamorphic in origin, while the western ranges, as well as the Allegheny Plateau, are made up of sedimentary rocks. Different series of soils have, therefore, been formed in different parts of the mountains and plateau. The igneous and metamorphic rocks give rise to the soils of the Porter series, while the Dekalb and

Upshur series are formed from the weathering of the sandstones and shales of sedimentary origin.

The character of the topography in the mountain and much of the plateau region is such that general farming is not practicable. The regions are, however, well suited to grazing and fruit growing, and these are very important industries.

Figure 13 shows diagrammatically the relative extent of the several important groups of soils in this province.

THE SANDY LOAM GROUP.

A moderate extent of the sandy loam group of soils is found in this province. Four types are represented. It is interesting to note that the sandy loams are the lightest textured soils so far encountered.

TABLE LXXX.—*Area and distribution of the sandy loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb sandy loam	Ala. 4, 6, 12, 13; Ohio 6; Pa. 7; Tenn. 10, 11; W. Va. 4, 6	567,252
Porters sandy loam	N. C. 2, 11, 12, 14, 22; S. C. 3; Va. 3	393,305
Morrison sandy loam	Pa. 3, 5	20,352
Upshur sandy loam	Ala. 4, 13	8,896

[1] For key to numbers in this column, see p. 253.

Dekalb sandy loam.—The type consists of a gray to brown sandy loam surface soil of medium to fine texture, from 9 to 12 inches deep, resting on a yellowish-brown, slightly sticky sandy loam subsoil. It is derived from sandstone rock and occurs in rather level areas. Occasionally broken sandstone lies directly under the surface soil. This is an easily cultivated type and responds readily to fertilizers, but is not very productive. Some wheat is grown, but the average yield is not more than 7 bushels per acre. The yield of corn rarely exceeds 15 to 20 bushels, while cotton gives from 200 to 350 pounds of lint per acre. This soil is adapted to vegetables and very well adapted to early apples and peaches.

Porters sandy loam.—The soil consists of a grayish-yellow sandy loam, from 6 to 15 inches deep. The subsoil is a tenacious red clay. Both soil and subsoil contain fragments of quartz and other rocks. The type occupies mountain or high rolling lands and is derived from igneous rocks. Wheat, corn, oats, rye, potatoes, and fruit are the principal crops. The soil is adapted to early fruit, especially apples and peaches, and to early truck crops, potatoes, and rye. It is poorly adapted to wheat, corn, and oats.

Morrison sandy loam.—This type is composed of a gray to yellow sandy loam soil, about 8 inches deep, underlain with a yellow subsoil, which becomes heavier with depth until at 36 inches it is a heavy

loam or clay loam. It is derived from sandstone, and fragments of the parent rock are usually present. Areas of this soil occupy slopes and ridges in the "barrens" and have excellent drainage. They are adapted to early truck and fruit and a light type of general farming.

Upshur sandy loam.—The soil consists of gray to reddish-gray medium to fine sandy loam about 10 inches deep. The subsoil is a dark-brown to red sandy loam. The surface of the type varies from gently rolling to hilly and rugged, and sometimes on the steeper slopes rock fragments occur. The natural drainage is good. The soil is derived from the weathering of a brown or red sandstone. It should be used for vegetables, orchard fruits, and small fruits, and for light farming, when well cultivated.

THE FINE SANDY LOAM GROUP.

More fine sandy loam types than sandy loam have been mapped in this province, but the area of the former is only about half as great as of the latter. The soils are only moderately productive, though some areas are well suited texturally and as far as climate is concerned for the production of fruit.

TABLE LXXXI.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb fine sandy loam	Ala. 3, 4, 10, 12, 16, 17; Ky. 2; Mo. 12; Pa. 3, 4; Va. 9.	448,896
Porters fine sandy loam	S. C. 10	24,128
Upshur fine sandy loam	Ark. 2	17,472
Fayetteville fine sandy loam	Ark. 1	17,216
Morrison fine sandy loam	Pa. 5	1,600
Palatine fine sandy loam	N. Y. 9	1,280
Hanceville fine sandy loam	Ala. 3	384

[1] For key to numbers in this column, see p. 253.

Dekalb fine sandy loam.—The type consists of a fine compact sandy loam, from 8 to 12 inches deep, resting upon a subsoil of similar material, which becomes more loamy as the depth increases. It is derived from sandstone. The soil is not naturally productive, and small crops are obtained unless heavy fertilization is practiced. With proper cultivation it is fairly well adapted to fruit and truck crops.

Porters fine sandy loam.—The soil is a gray or yellowish fine sandy loam varying from 6 to 12 inches in depth. The subsoil varies from a yellowish-brown heavy fine sandy loam to a light fine-textured sandy clay. At depths ranging from 30 to 60 inches the subsoil grades into the parent rock and eroded areas occur where the rock lies closer to the surface or is sometimes exposed. There are also

small sheltered coves, where the soil is deeper and darker colored. The surface is rough and mountainous and the drainage is excessive. The type is derived through weathering from granitic rocks. The areas are forested with scrubby oak, pine, and chestnut on the ridges. On the sheltered slopes mountain laurel and rhododendron form a dense undergrowth. Practically none of the type is in cultivation, and it should remain in forest.

Upshur fine sandy loam.—The soil consists of a yellowish-brown fine sandy loam from 8 to 15 inches deep. The subsoil is usually a medium clay loam or a stiff, fine sandy clay of a reddish-brown, dull red, or drab-brown color. In a few small areas the heavy lower subsoil is replaced by a yellow fine sand. Over small areas sufficient iron salts are present to cause the soil particles to cement together, forming a crust or hardpan in the lower part of the surface soil. In general, the type occupies moderately rolling areas, but it sometimes occurs in scattered areas on steep slopes and flat-topped hills or small mountains. It is derived from fine-grained brown to red sandstone and in some instances partly from shale. An occasional feature of the sandstone formation is the presence of limestone lentils. Surface drainage is generally well established. The type, except in areas of hardpan, is well adapted to the growing of apples, peaches, and small fruits. Small yields of general farm crops are also obtained.

Fayetteville fine sandy loam.—The soil consists of 8 to 12 inches of gray to reddish-gray fine sand with varying amounts of silt. The subsoil is gray to reddish-gray fine sandy clay, extending to depths of 10 to 20 feet. A small amount of fine gravel occurs in the soil and subsoil. The surface is level to gently rolling and during an average year the drainage is sufficient. The type is derived from fine gray sandstones of the Millstone grit formation, which have a siliceous cement. Oaks and hickory form the native vegetation. The crops grown are corn and cotton, but the soil is an excellent upland truck soil and profitable crops of peanuts, cowpeas, and potatoes may be secured.

Morrison fine sandy loam.—The soil is a gray, loose, incoherent, very fine sandy loam or fine sand, seldom over 6 inches deep. The subsoil to 36 inches is a light-yellow, loose, incoherent, fine sand or light fine sandy loam containing considerable sand of all grades. Quartz gravel occurs on the surface and throughout the soil and subsoil. Some fragments of sandstone and conglomerate are strewn upon the surface. The type occupies gently sloping to very steep hillsides with excellent drainage. It is derived from the Oriskany sandstone. The original forest growth is composed of oak and chestnut. The type is not a good general farming soil, owing to

inability to hold fertilizers, but it is used for wheat, corn, oats, and gardening with moderate success.

Palatine fine sandy loam.—The soil is a dark-brown to black fine sandy loam 8 inches in depth. The subsoil is a heavy dark-brown to black fine sandy loam, which rests upon the bed rock at depths ranging from 26 to 48 inches. The type is rolling to hilly and has good natural drainage. It is well suited to the production of corn, clover, and grass. Alfalfa is successfully grown. Good yields of potatoes and root crops are also secured.

Hanceville fine sandy loam.—The soil of this type is a grayish or reddish fine sandy loam 6 or 8 inches in depth. The surface material is underlain by a reddish to bright-red or brick-red heavy fine sandy loam or sandy clay. The type is developed in connection with the Dekalb soils and is derived from sandstone. The high coloring of the subsoil seems to be due to the presence of iron salts. The topography is undulating to rolling and hilly. The soil should be used for early truck and fruit and light general farm crops.

THE LOAM GROUP.

The loam group of soils is the most extensive of the province and includes some of the best types for general agricultural as well as for fruit growing.

TABLE LXXXII.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Porters loam	N. C. 2, 11, 22; S. C. 10	436,160
Dekalb loam	Ala. 6, 10; Ky. 2; Pa. 2, 3, 4, 5; W. Va. 2, 5, 6	276,416
Fayetteville loam	Ark. 1	44,352
Talladega loam	S. C. 10; Va. 9	42,752
Upshur loam	Ala. 17; Ark. 2; Pa. 3, 5	20,288
Morrison loam	Pa. 3	5,760
Hanceville loam	Ala. 10, 12	3,776
Paris loam	Va. 9	1,536
Chandler loam	Va. 9	384

[1] For key to numbers in this column, see p. 253.

Porters loam.—The soil consists of a dark-red or gray loam from 6 to 15 inches deep. The subsoil is a tenacious red clay. Both soil and subsoil contain fragments of quartz and other rocks. The type occupies mountain or high rolling lands and is derived from igneous rocks. Wheat, corn, oats, rye, potatoes, and fruit, especially apples, are the principal crops.

Dekalb loam.—The soil is a fine-textured loam of light-brown or yellowish color and from 10 to 15 inches deep. The texture becomes heavier as the depth increases and the material grades finally into a

light-yellow silty clay or clay subsoil, often mottled with gray or drab, which extends to a depth of 3 feet or more. The subsoil rests upon a mass of disintegrated sandstone, beneath which is found the bed rock. Sandstone fragments are usually scattered over the surface and some iron concretions also occur. The type occupies ridges with a surface varying from deeply dissected to broad and gently rolling. It is well drained and in some situations is subject to erosion. This is a residual soil derived from a very fine grained sandstone. It is an excellent type for general farming, potatoes and other vegetables, melons, small fruits, and tobacco. Corn yields from 35 to 60 bushels, hay from 1 ton to 1½ tons, oats from 35 to 50 bushels, and wheat about 15 bushels per acre.

Fayetteville loam.—The soil is composed of yellow to reddish-yellow material, consisting mainly of silt with some fine sand. It carries a small proportion of organic matter. The subsoil consists largely of yellow and mottled yellow and red silty clay which always rests upon more or less decomposed shale. The surface is gently rolling, and only in depressed areas is drainage deficient, though the soil has a tendency toward puddling and consequent slow water movement when not properly cultivated. Japan clover is a characteristic plant. Most of the type is under cultivation to corn and cotton, though potatoes, cabbage, strawberries, and other truck and fruit are products for which the type is better adapted.

Talladega loam.—This soil consists of a yellowish-gray to yellowish-brown loam, 8 to 12 inches deep, containing a small percentage of sand and some very small fragments of rock. The subsoil is a yellowish-red to brownish clay loam grading into a heavy red clay, not very tenacious nor plastic, containing small subangular gravel, some sand, and having a slick, greasy feel. The topography ranges from hilly to gently rolling, and the drainage is at all times good. The type is derived through weathering from mica schists, talcose schists, and coarse-grained sandstone. Quartz and schist fragments frequently occur in the soil. Corn and wheat are the leading crops, though oats and grasses are grown to considerable extent.

Upshur loam.—The soil consists of about 8 inches of loam, varying from brown to dark Indian red in color. The subsoil ranges from clay loam to heavy clay, usually of a red-brown to a deep Indian red color. The surface varies from flat to gently rolling or occasionally hilly. The type is derived from the weathering of a fine-grained red shaly sandstone and is naturally well drained. It is productive and well adapted to cotton, corn, and forage crops. Vegetables, orchard fruits, and small fruits do well on the lighter and higher lying areas.

Morrison loam.—The soil, which has a depth of 8 to 10 inches, consists of a heavy loam. The subsoil is a reddish-yellow clay loam to

clay. Sandstone fragments are of common occurrence. This soil occurs as rolling land in the "barrens." It gives good yields of general farm crops as well as of berries and truck crops.

Hanceville loam.—The type consists of about 6 inches of dark reddish brown loam; the subsoil is usually a brick-red silty clay. The type is derived from sandstone and shale, which, while not noticeably red, form soils of much deeper coloring than the yellowish Dekalb soils with which they are closely associated. They, however, do not possess the dull Indian red coloring of the Upshur series. The Hanceville loam ordinarily occurs in small areas, often only a few acres in extent. It is more productive than the Dekalb soil and good yields of the ordinary farm crops as well as fruit are secured.

Paris loam.—The type consists of 10 inches of a dark-brown to very dark gray loam, underlain by a brownish to reddish-brown clay which grades at about 20 inches into a heavy reddish to reddish-brown clay. Numerous huge bowlders of rock outcrop irregularly. The type occupies the crests of mountains and their upper slopes. Drainage is good, and the yields, particularly of corn, are moderately large.

Chandler loam.—The type consists of 8 to 12 inches of a grayish loam, underlain by a yellow to reddish-yellow loam, which becomes heavier and redder with depth. Sandstone and quartz fragments occur on the surface and through the soil. The surface is hilly to rolling, and the drainage is good. The soil is derived from underlying micaceous material.

BLACK LOAM PHASE.

The black loam phase, by reason of peculiar adaptation to fruit growing, is an important variation from the typical loams of the Appalachian province. Its use is limited somewhat by inaccessibility and steepness of surface.

TABLE LXXXIII.—*Area and distribution of the black loam.*

Name of soil.	State and area.[1]	Acres.
Porters black loam	N. C. 2, 11, 12, 14, 22; Va. 1, 3	193,550

[1] For key to numbers in this column, see p. 253.

Porters black loam.—The soil is a rich, dark loam about 15 inches deep, mixed with rounded and angular fragments of rock often several feet in diameter. The subsoil is a yellowish-brown or reddish clay loam, containing a large percentage of rock. The type occupies the steep slopes of the higher mountains and is of residual origin, being derived from granite, gneiss, and similar rocks. The soil is

productive, but the slopes are too steep and stony to admit of extensive cultivation for general farm crops. It is especially adapted to apples, particularly the Albemarle pippin. For this apple the small coves on the east side of the mountains are considered most desirable. Where in more exposed position, as on the top of the mountains, it has little value for fruit and is used only for grazing.

SHALE LOAM PHASE.

A number of different soils have been placed in the shale loam phase. Some of them are extensive. The types are found from New York southward to Alabama.

TABLE LXXXIV.—*Area and distribution of the shale loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb shale loam	Ala. 6, 10, 12, 17; Ky. 2; Md. 7; Pa. 3, 4, 5, 6, 7, 8, 9; Tenn. 4, 5; Va. 1, 3; W. Va. 1.	869,172
Conasauga shale loam	Tenn. 4	20,288
Allis shale loam	N. Y. 8, 14	13,248
Montevallo shale loam	Ala. 3, 6	10,816

[1] For key to numbers in this column, see p. 253.

Dekalb shale loam.—The soil has an average depth of 8 inches and consists of a brown to yellowish loam or clay loam. The subsoil is a yellowish or sometimes slightly reddish clay loam, increasing in clay content with depth and grading into stiff clay resting upon a mass of broken shale fragments at depths rarely exceeding 24 inches. On the surface and throughout the soil and subsoil are scattered varying quantities of weathered shale fragments, the content usually increasing with depth. The surface features consist of smooth rounded knobs and ridges with narrow intervening valleys. The type is derived from sandy to argillaceous and more or less calcareous shales. The soil is heavy and droughty and is best adapted to grain and grass crops.

Conasauga shale loam.—The soil to a depth of 6 to 9 inches is a gray to brownish silt loam, or very fine sandy loam, containing numerous shaly sandstone and soft shale fragments. The subsoil varies from a yellowish heavy silt loam to a light-brown silty clay. Its shale content increases with depth and the material gradually passes into solid rock. In numerous small areas both the soil and subsoil are little else than a mass of soft shale varying from green to yellowish brown in color. The type occupies broken, hilly, and mountainous areas. It is derived from calcareous and very fine grained sandy shales, interstratified with thin layers of sandstone. The greater part of the type is forested with pine, chestnut, and oak.

Small areas are cultivated in corn which is the principal crop. The soil should be used for fruit growing. Peaches do exceptionally well.

Allis shale loam.—The type consists of a heavy dark-drab or brown loam or clay loam from 7 to 10 inches deep, resting upon a subsoil of heavy loam or clay loam, similar to the surface soil except in color which is a little lighter. Both soil and subsoil are filled with small, thin shale fragments which are brittle and easily broken. On some of the steeper slopes a phase of this soil exists, where the subsoil is entirely wanting, the soil resting directly on the rock. In these areas the percentage of shale fragments is greatly in excess of that in the gentler slope areas and consists of larger pieces. The type occupies steep slopes and is derived from the weathering of shale rock. It is well adapted to grains and grasses and excellent yields are obtained. Owing to its rough topography, however, it is probably best used for pasture.

Montevallo shale loam.—The type consists of purplish or brownish floury silty loam, 7 inches deep, underlain by silty clay or clay loam of the same color as the soil. The subsoil often rests upon the parent shale or sandstone rock at about 2 feet below the surface, and fragments of the same formations which show a wide range of color are found upon the surface and throughout the soil profile. The type is derived from these variegated rocks, which are usually fine-grained sandstones to slightly sandy shale. The topography is rolling to hilly, and sometimes mountainous and ridgy, with steep slopes. On the more level or gently sloping areas some of the type is cultivated, though for the most part it is better adapted to forestry and grazing.

THE SILT LOAM GROUP.

Nearly all of the area in the silt loam group is comprised in one type of soil. Much of its area is rough and hilly and better adapted to grazing than to agriculture. Many areas are likely to be droughty. Of the minor types in the group some are very good general farming soils. The differences in value are brought out in the type descriptions following:

TABLE LXXXV.—*The silt loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb silt loam	Ala. 9, 12, 17, 27; Ind. 9; Ky. 2, 6; Ohio 5, 6; Pa. 3, 5; Tenn. 4, 5, 10; Va. 9; W. Va. 2, 3, 4, 6.	1,122,944
Conway silt loam	Ark. 1	38,912
Colyer silt loam	Pa. 3	4,928
Palatine silt loam	N. Y. 9	3,840
Upshur silt loam	Va. 9	2,624

[1] For key to numbers in this column, see p. 253.

Dekalb silt loam.—The soil is a mellow loam or silt loam of a gray, brown, or yellow color, from 8 to 20 inches deep, with an average depth of 14 inches. The sand constituent is of the finer grades, and this, with the large silt content, gives the soil the character of a mellow silt loam. The contact between soil and subsoil is nowhere sharp. The subsoil is a silty clay loam, neither plastic nor tenacious. It is characteristically yellow, but lighter in color than the soil because of the absence of organic matter. Unweathered rock is often encountered at a depth of less than 3 feet, and nearly everywhere fragments of shale or shaly sandstone are scattered upon the surface and through the soil. The type covers hilly uplands, more broken surface near the streams and smoother and more gently rolling at a distance, the latter condition being the character of the greater part of the type. The topography promotes rapid and thorough drainage. The soil is not retentive of moisture, though with the rainfall usual in the regions where it occurs crops seldom suffer seriously from drought. The tendency to wash and gully is not so great as in many soils of similar topography. The steep hillsides, however, should not be planted to cultivated crops. This is a residual soil, derived through weathering from interbedded shales, sandstones, sandy shales, and limestones. Corn, wheat, and timothy are the most important crops. Much of the hilly and stony land is unfit for cultivation, but is well adapted to grasses. Extremely rough areas are still in forests of hardwood.

Conway silt loam.—The type consists of close structured yellow to gray silt loam soil, 6 inches deep, resting on a yellow to nearly white subsoil of similar texture. Both soil and subsoil carry iron concretions, and in some places an iron hardpan is found in the subsoil. The type is characterized by numerous mounds, 10 to 15 feet in diameter and 2 to 6 feet high. The type is developed both on upland and in close proximity to streams. The areas have a gently rolling to flat surface and are low and wet. Large areas must be ditched to facilitate cultivation. Some of the type appears to be a true second bottom, while the upland proper is a residual soil from shales. A large percentage of the type supports a virgin growth of oaks. Various lowland grasses are characteristic. Areas under cultivation produce only indifferent yields of corn and cotton. Heavy liming and improvement of the physical conditions in other ways are the principal needs of the soil.

Colyer silt loam.—The surface soil consists of 8 to 10 inches of yellow to yellowish-brown silt loam of loose friable texture. The subsoil is a yellow heavy silty clay loam which at depths of 24 to 40 inches rests on soft black carbonaceous shale. The soil has a tendency to bake after rains, but crumbles readily upon cultivation. Locally the type is known as "soapstone land," and is considered a good soil.

It occurs in small areas along the foot of mountain slopes, the surface consisting of rounded hills and smooth rolling areas. It is thoroughly drained and during very dry seasons crops suffer for lack of moisture. In normal seasons it gives good yields of the general farm crops.

Palatine silt loam.—The soil of the Palatine silt loam is a very dark brown to black silt loam, from 12 to 18 inches deep, and having a granular structure. The subsoil to an average depth of 30 inches is a dark-colored silty loam, grading into a clay loam. At a depth of 36 to 60 inches the subsoil rests on black calcareous shales, from which it is derived. The topography is rolling to somewhat hilly, and surface drainage and subdrainage are good. This is a strong soil for corn, clover, and grass. Alfalfa can be successfully grown. Potatoes yield well and oats fairly well.

Upshur silt loam.—The soil is a purplish-gray or Indian-red silt loam 8 to 15 inches deep. The subsoil is a heavy purplish-red compact silt loam grading into a reddish-brown silty clay which gives way to decomposing shales of reddish to yellow color. The quantity of shale fragments increases from the surface downward. Many sandstone fragments occur in some localities. The type occupies rounded hills and ridges with more or less broken surface and the drainage is always good. It is derived from red sandstones, shales, and sandy shales. The timber growth is scrubby hardwood, with some pine. Cultivated areas give only fair yields of corn, wheat, and hay.

STONY SILT LOAM PHASE.

A single type of soil of the stony silt loam phase has been encountered so far in the soil survey. Table LXXXVI gives the area and distribution:

TABLE LXXXVI.—*Areas and distribution of the stony silt loam.*

Name of soil.	State and area.[1]	Acres.
Dekalb stony silt loam	Ala. 12; Pa. 3	54,016

[1] For key to numbers in this column, see p. 253.

Dekalb stony silt loam.—The soil is a light-brown to pale-yellowish heavy silt loam with a depth of 6 inches. The subsoil is a pale-yellow heavy silt loam changing in the lower portion into a rather plastic silty clay loam or clay. In places, especially on the lower slopes, the subsoil is mottled yellow and drab. Usually on the top and upper slopes of ridges it is difficult to bore with the soil auger deeper than 2 feet, on account of the abundance of broken stone.

There is, however, interstitial soil material down to bed rock. The type is derived from thin-bedded shale and sandstone. It occupies large, rounded hills, irregularly developed ridges, and steep slopes. Erosion is quite active in places. Much of this land is timbered with pine, oak, chestnut, and hemlock. There are, however, many farms of considerable size. The yields of the general farm crops—corn, wheat, oats, and grass—are fair. Oats do better than other grains. Corn and buckwheat give better yields than on the Dekalb shale loam. Clover does exceptionally well with the use of lime. Certain varieties of apples can be successfully grown.

THE CLAY LOAM GROUP.

While the clay loam group is the third in extent in the province by far the greater part of it is rough rolling land poorly adapted to agriculture. Some of the better areas give moderate yields of the general farm crops. Aside from this, grazing and forestry constitute the chief sources of income.

TABLE LXXXVII.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Meigs clay loam	Ohio 6; W. Va. 2, 3, 4	1,359,552
Montalto clay loam	Pa. 1, 9	45,376
Lickdale clay loam	Pa. 2, 4, 5, 7, 8, 9; Tenn. 11	34,640
Porters clay loam	S. C. 10	26,432
Dekalb clay loam	Pa. 3	15,488
Morrison clay loam	Pa. 3	1,280

[1] For key to numbers in this column, see p. 253.

Meigs clay loam.—The soil is a grayish-brown silt loam to clay loam, varying in depth from 2 to 7 inches. The subsoil, to a depth varying from 10 to 20 inches, is generally a compact but friable yellowish silt loam or clay loam, below which depth it usually grades into a brittle clay, extending to a depth of more than 3 feet and generally having a yellowish or mottled yellowish-red and yellow color. Small pockets of brownish-yellow sand occur in the subsoil, and fragments of shale and shaly sandstone occur throughout the soil and subsoil. Shale rock is often found at depths varying from 2 to 3 feet. The topography, in general, is hilly and rough, but over some comparatively small areas the slopes are more moderate and the outline well rounded. The type is derived from the shales and sandstones of the Upper and Lower Coal Measures. A small part of it is cultivated. It is not naturally a strong soil, but fairly good yields are obtained by the use of fertilizers. The principal crops are corn, wheat, and hay. The greater part of the type is best adapted to pasture.

Montalto clay loam.—The soil consists of light-brown to brownish-red clay loam averaging about 8 to 10 inches in depth. The subsoil is a yellowish-brown to yellowish-red clay which sometimes carries a considerable amount of small gravellike particles from the parent rock. The type is derived chiefly from trap rocks. It usually occupies rolling to hilly upland, sometimes occurring in narrow strips following the line of the intrusive dikes from which it is derived. The drainage is good, surface drainage sometimes being so rapid as to cause excessive erosion. Corn, wheat, oats, and hay are the principal crops. Under ordinary methods corn yields from 30 to 40 bushels; wheat, 15 bushels; oats, 30 bushels; and hay, 1½ tons per acre.

Lickdale clay loam.—The type consists of clay loam 6 to 10 inches deep underlain by a mottled yellow clay. It occurs in small areas at the foot of the Blue Ridge Mountains and is derived from the wash of the mountains and the adjacent shale formations. Sometimes fragments of gray sandstones are present to the extent of from 5 to 20 per cent. It forms low-lying, flat areas and is poorly drained. Naturally it is very refractory, and is suited only to grass and pasture, but when artificially drained it becomes mellow and may be used to produce a variety of crops.

Porters clay loam.—The soil varies in depth from 3 to 5 inches, and where the surface is rolling it consists of a brown silt loam to reddish-brown clay loam. The subsoil is a reddish clay loam or clay. Surface features vary from rolling to rough and mountainous and the drainage is good. The lighter textured soil occurs in rolling areas and the clay loam areas in rougher country. The type is derived from a schist. The timber growth consists of scrubby oak and pine with a dense undergrowth of bushes. Fair yields of corn, sorghum, and other crops are produced for home use in locations where the surface is rolling. Broken and mountainous areas should be allowed to remain in forest.

Dekalb clay loam.—The soil is a drab to pale-yellow heavy silty loam or silty clay loam 8 to 10 inches deep. The subsoil consists of a pale-yellow heavy silty clay loam, which generally grades into a yellow rather plastic silty clay, slightly mottled with reddish-drab and brown colors. The type occurs on the gentler or lower slopes of hills and ridges. It is derived through weathering from shale and slate rocks. Some of the finer material of the soil has been washed from higher lying areas. The type is deficient in lime. It is somewhat cold and in places rather poorly drained. The cereals and grasses give best results.

Morrison clay loam.—The soil is a brown or yellowish-brown silty clay loam with a depth of 6 to 8 inches. The subsoil is a reddish-yellow friable clay loam to clay. This type occupies rolling areas in the "barrens" and along the line between the "barrens" and

the limestone soils. It is derived largely from sandstones, with possibly some admixture of material from limestone near the contacts with limestone soils. The type is largely timbered and would better remain so.

THE CLAY GROUP.

In extent the clay group is next to the last of the several groups found in this province. The soils are rather better than those of light texture, and some of them give very good yields of the general farm crops. Among the number are soils especially adapted to the production of apples and peaches.

TABLE LXXXVIII.—*Area and distribution of the clays.*

Name of soil.	State and area.[1]	Acres.
Porters clay	N. C. 2, 11, 12, 14, 22; Pa. 1; S. C. 3, 10; Va. 1, 3, 7; W. Va. 1	292,509
Dekalb clay	Ala. 4, 22; N. Y. 15; Ohio 3; Pa. 5; W. Va. 5	153,380
Upshur clay	N. Y. 8, 11; Ohio 6; W. Va. 2, 3, 4, 5, 6	96,064
Conasauga clay	Ala. 6, 12, 17	64,768
Allis clay	N. Y. 8	2,304

[1] For key to numbers in this column, see p. 253.

Porters clay.—The type consists of a reddish-brown clay loam about 6 inches deep, underlain by a stiff, tenacious red clay to a depth of 20 inches or more. Both soil and subsoil contain a large percentage of stone. The type occupies mountain slopes. This is a residual soil derived from granite and other crystalline rocks. When not too stony and rough it produces good crops of corn, wheat, and grass. It is one of the important apple soils of the mountains, particularly for Winesap and similar varieties.

Dekalb clay.—The soil consists of about 8 inches of grayish-brown loam or clay loam, often containing much silt, underlain to a depth of 36 inches or more by a yellowish-brown to reddish-yellow clay. Both soil and subsoil usually contain from 10 to 40 per cent of small shale fragments. The usual topography is hilly, and the natural drainage is good. The soil is derived from the weathering of shales. It supports a timber growth consisting mostly of oak, hickory, beech, and pine. Where cleared and cultivated fair yields of cotton, corn, vegetables, sorghum, and forage crops are secured. The higher ridges are suited to peaches and other orchard fruits.

Upshur clay.—The type consists of a stiff dark-red clay about 7 inches deep, underlain by a lighter colored red clay of nearly the same texture. It occupies steep hillsides, though occasionally extending down into valleys, and suffers much from erosion. Exposed areas are inclined to bake and crack in dry weather. The type is the direct product of the weathering of red shales. It is used mainly

for pasture, but the more gently rolling areas produce good crops of wheat, corn, and grass.

Conasauga clay.—The type consists of 6 or 8 inches of a light grayish yellow silt, containing considerable clay, overlying a heavy clay subsoil of pale-yellow color. It occupies rather level topography in the Coosa Valley of Alabama and Georgia, and is locally known as "flatwoods." It is derived from shale rock, nearly vertically inclined, interstratified with seams of limestone varying from less than an inch to several feet in thickness. Much the larger proportion of the material is derived from shale and the resulting soil is quite similar in general appearance to that derived from the finer grained sandstone and shales of the Coal Measures as seen in the Dekalb series. The agricultural value is about the same as that of the finer textured members of the Dekalb series.

Allis clay.—The soil consists of a gray or olive-colored silty clay or clay loam, with an average depth of 8 inches. The subsoil is a silty clay or clay slightly heavier than the soil and lighter in color, sometimes being mottled gray. There is no distinct dividing line between the soil and subsoil and the latter very often passes into bed rock in the lower part of the section. The topography varies from level to steeply rolling. This is a residual soil formed from the weathering of the light colored Salina shales. Sometimes there are a few glacial stones on the surface, but no considerable quantity of other glacial material. The soil is adapted to general farm crops and to dairy farming. Corn, oats, and hay are the principal crops grown and all do well. Wheat is not much grown but gives fair yields.

SOILS OF SUBORDINATE VALUE.

SANDS.

TABLE LXXXIX.—*Area and distribution of the sands.*

Name of soil.	State and area.[1]	Acres.
Porters sand	N. C. 2, 11, 12, 14; S. C. 3; Va. 1	216,710
Dekalb sand	Pa. 3	19,200
Morrison sand	Pa. 3, 5	1,216

[1] For key to numbers in this column, see p. 253.

Porters sand.—The type consists of a grayish-yellow coarse sand about 10 inches in depth, overlying coarse sand and masses of broken rock. Fragments of rock and huge bowlders are scattered on the surface. It is derived through weathering from granite, gneiss, and similar rocks. It occupies mountain slopes and where the slopes are not steep the soil is used to some extent for light general farming. Formerly bright tobacco was grown. The soil is best adapted to peach and grape culture.

Dekalb sand.—The type consists of a gray to pale-yellow medium sand underlain at a depth of 5 inches by slightly heavier and more compact yellow to reddish-yellow sand. The immediate surface in forested areas is usually dark colored, on account of the presence of organic matter. This soil occupies level to gently rolling tops of high ridges in the Allegheny Plateau. It is derived from sandstone and sandstone conglomerate. It is best left in forest.

Morrison sand.—The soil is a loose, gray, incoherent, white sand 6 inches deep, containing some organic matter. The subsoil to 36 inches is a loose, incoherent, yellow sand or sandy loam. Some small sandstone fragments are scattered on the surface. The type occupies the tops of knolls and ridges in the "barrens" and has excellent drainage. It is derived from sandstone. It supports a mixed growth of chestnut, jack pine, and scrub oak. It is not in cultivation and should be left in forest.

STONY SAND.

TABLE XC.—*Area and distribution of the stony sand.*

Name of soil.	State and area.[1]	Acres.
Dekalb stony sand	Pa. 3	70,016

[1] For key to number in this column, see p. 253.

Dekalb stony sand.—The soil consists largely of light gray to pale yellow medium sand to loamy sand. The immediate surface is dark colored, owing to the presence of organic matter. The subsoil is yellowish to reddish-yellow slightly loamy sand. The average depth of the soil is about 5 inches, but there is no distinct line of demarcation between soil and subsoil. Throughout the profile there occur varying quantities of weathered sandstone conglomerate, from which the type is derived, and here and there ledges of the rock outcrop. The land requires to be cleared of rocks before cultivation of any considerable fields can be undertaken. The type occupies mountains and high plateaus and very little of it is under cultivation. Fair yields of wheat, rye, and oats are secured. Buckwheat and potatoes can be grown with fair success.

STONY SANDY LOAMS.

TABLE XCI.—*Area and distribution of the stony sandy loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb stony sandy loam	Pa. 5	18,688
Upshur stony sandy loam	Pa. 5	2,368

[1] For key to numbers in this column, see p. 253.

Dekalb stony sandy loam.—The type consists of a loose constructured, gray to dark-gray sandy loam, 7 or 8 inches in depth, underlain to 36 inches by a dark-yellow slightly sticky sandy loam. The surface soil contains considerable organic matter, but the texture is such as to allow rapid leaching of fertilizers. Quartz gravel and fragments of sandstone and conglomerate are usually present in sufficent quantities to interfer with cultivation. The type occupies crests of mountains and has excellent drainage. It is derived from the weathering of sandstone, the incomplete disintegration of which has given rise to the stony character of soil. Chestnut is the principal growth. Little of the soil is in cultivation and it can probably be made to yield better returns if devoted entirely to forestry.

Upshur stony sandy loam.—The soil consists of 8 or 10 inches of reddish-gray sandy loam. This surface material becomes sandier and redder with depth until at about 36 inches it grades into a rather loose structured Indian-red sandy loam. Sandstone fragments and bowlders are numerous on the surface. The type occurs as high terraces along the sides of mountains and has excellent drainage. It is derived from the weathering of the red and gray sandstones of the Medina group. It is in forest and supports a fair growth of chestnut and oaks. It is suited only for forestry.

GRAVELLY LOAMS.

TABLE XCII.—*Area and distribution of the gravelly loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb gravelly loam	Pa. 9	4,800
Talladega gravelly loam	Va. 9	2,752

[1] For key to numbers in this column, see p. 253.

Dekalb gravelly loam.—This type is composed of surface soil of brown loam or heavy sandy loam, with a depth of 8 to 12 inches, resting upon a subsoil of light-yellow loam. From 5 to 30 per cent of fine quartz gravel occurs in the soil, and the content of this material increases with depth. The type occupies ridges and hills and sometimes the intervening depressions. It is derived from the weathering of the Potsdam conglomerate. The drainage is well established, and crops are liable to suffer in dry seasons from lack of moisture. The type is fairly well adapted to general farm crops.

Talladega gravelly loam.—The soil is a yellowish-gray loam containing a high percentage of small quartz fragments and often a quantity of very white quartz fragments of rather larger dimensions. The subsoil, to a depth of 36 inches, is a pale yellowish to yellowish-red clay loam to clay with a greasy feel. The type occu-

pies crests or slopes of hills and is derived from crystalline material of Archean age. Except for forest it is not highly valued.

SLATE LOAM.

TABLE XCIII.—*Area and distribution of the slate loam.*

Name of soil.	State and area.[1]	Acres.
Talladega slate loam	Ala. 6, 27	115,584

[1] For key to numbers in this column, see p. 253.

Talladega slate loam.—The soil consists of 4 inches of dark-gray or light-brown silt loam. The subsoil is a dark-red clay loam or clay to a depth of 20 inches, where the fragmentary rock mass is encountered. Both soil and subsoil have a decidedly soapy or greasy feel, imparted by small partially decomposed slate fragments. Large pieces of slate rock and fragments of quartz and quartzite occur on the surface. The topography is rough and mountainous, the result of an eroded plateau on which drainage is rapid and erosion still very active. It is a residual soil derived from imperfectly crystalline or talcoid slates, carrying veins of quartz and quartzite. It is best adapted to forestry though cereals and grasses do well. Corn and cotton yield small returns.

STONY LOAMS.

TABLE XCIV.—*Area and distribution of the stony loams.*

Name of soil.	State and area.[1]	Acres.
Dekalb stony loam	Ala. 6, 9, 10, 13; Md. 7; N. C. 10; Pa. 1, 2, 3, 4, 5, 6, 7, 8, 9; Tenn. 4, 5, 10, 11; Va. 1, 7, 9; W. Va. 1, 5.	1,103,828
Fayetteville stony loam	Ark. 1	118,400
Upshur stony loam	Ala. 17; Ark. 2; Pa. 3, 5	105,088
Porters stony loam	Ga. 2; N. C. 1, 12, 21; Pa. 1	81,734
Montalto stony loam	Pa. 2, 9	16,832
Talladega stony loam	Ala. 27	15,552
Lickdale stony loam	Ala. 27	4,416
Montevallo stony loam	Ala. 27	4,032
Chemung stony loam	Pa. 5	3,328
Morrison stony loam	Pa. 3	2,048
Chandler stony loam	Ala. 27	1,664

[1] For key to numbers in this column, see p. 253.

Dekalb stony loam.—The type consists of a gray to yellowish sandy loam soil, from 6 to 10 inches deep, grading into a subsoil of slightly heavier texture and yellower color. In some places the subsoil approaches more nearly a true clay. Both soil and subsoil contain a

large quantity of sandstone, conglomerate, and calcareous sandy shale fragments, and the subsoil frequently rests directly upon a mass of broken rock. The topography is very rough and broken. Owing to the character of the surface and the large quantity of stone, the soil is not very productive, although where the clay subsoil prevails and a part of the stones are removed fair crops are produced. With proper location and elevation the better areas of the sandy and sandy loam phases are well adapted to peaches. Where wheat is grown the soil produces a small yield of bright, heavy grain. The native forest growth consists mainly of chestnut and white oak, with some hickory, black gum, and red oak.

Fayetteville stony loam. The soil is composed of various grades of rock material, ranging from clay to good-sized gravels and stones. The gravel is largely shale and sandstone fragments and extends to great depths. Though the texture and structure is variable over wide areas, the soil is usually of a gray to reddish-gray color and uniformly about 14 inches deep. The subsoil varies from fine sandy and gravelly material to clay and silt. In depth it ranges from 1 to 30 feet, and it is always underlain by flat rock masses. The type occurs on rolling to hilly upland, and the natural drainage is well developed. It is a residual soil, derived from the shales and more ferruginous members of the Millstone grit strata of the Coal Measures. The natural forest growth is post oak, black oak, and blackjack oak, with some hickory and various shrubs. This is a promising soil for apples, peaches, and grapes. The present crops are corn, cotton, some apples, and grapes, which under existing methods of culture give only fair yields.

Upshur stony loam.—The type consists of a yellowish-brown fine sandy loam from 8 to 20 inches deep, underlain by a dull-red, reddish-brown, or grayish-brown fine sandy clay or clay loam. A phase is found composed of brown or grayish-brown medium to heavy loam, 6 to 12 inches deep, overlying stiff dull-red, brown, reddish-brown, or grayish-brown clay loam. From 15 to 60 per cent of fine-grained sandstone and other rock fragments are found on the surface and mingled with the surface soil. The subsoil may be entirely free from rock fragments, but considerable quantities are often present. The type is moderately to steeply rolling, a large part of it being found on lower slopes leading to higher lying Rough stony land. It is derived from the weathering of sandstone and shale. Surface drainage is rapid and often is attended by injurious washing of the slopes. Excepting the obstruction of stones, a large part of the type can be cultivated and is fairly well adapted to general farm crops and the growing of tree fruits. The more stony portions are best used for pasture.

Porters stony loam.—The soil is a grayish-yellow sandy loam about 10 inches deep, mixed with fragments of sandstone and other rocks.

The subsoil grades from a reddish-brown clay loam to a stiff red clay in lower depths, and contains some coarse sand and a large percentage of sandstone fragments. The type occupies rolling valley lands and gentle slopes of mountains. The soil is colluvial, being derived from wash from the mountains, but the subsoil is derived from the decomposition of underlying rocks. The type produces good crops of wheat, corn, grass, tobacco, rye, and apples.

Montalto stony loam.—The soil, to an average depth of 8 inches, is a reddish-brown, rusty, or light-brown heavy silty loam, with frequent slightly eroded areas of clay loam. The material is frequently gritty, and 20 to 40 per cent of ironstone fragments are mingled with the surface soil. The subsoil consists of reddish-brown, yellowish-brown or dull-red heavy gritty loam to clay loam, usually resting on bed rock at 2 to 6 feet. The subsoil contains numerous large and small rock fragments, often sufficient to prevent boring more than 15 inches below the surface. The type is a strong soil used largely for general farming. Corn gives an average yield of 40 bushels (shelled), wheat 18 bushels, oats 35 bushels, and hay 1¼ tons per acre. The type is adapted to apples, peaches, and grapes.

Talladega stony loam.—The type consists of an ashy-gray silty fine sandy loam, 8 to 15 inches deep, immediately underlain by a dark-red loam to clay 36 inches or more. On the surface and disseminated through the soil and subsoil occur large quantities of quartz fragments of varying size. Enough fine shale fragments occur in the subsoil to give a slightly greasy feel. The type occupies high hills with gentle slopes, and has good but not excessive drainage. It is a residual soil derived from slates and shaly sandstones which carry considerable quartz and quartzite. The native longleaf pine has largely been removed and the areas devoted to the production of cotton and corn, of which it makes excellent returns.

Lickdale stony loam.—This type consists of 6 inches of gray to light-yellowish ashy silty loam to fine sandy loam, underlain by yellow silt loam, loam, or silty clay loam. Throughout the soil profile there are large quantities of sandstone fragments of all sizes. The type is formed by débris and talus which has accumulated on mountain slopes and is of low agricultural value.

Montevallo stony loam.—The interstitial material of the surface soil consists of a light-brown or gritty silt loam or heavy sandy loam about 6 inches in depth. The subsoil is a yellow or reddish-yellow greasy silty clay loam changing to stiff red silty clay, which is underlain at about 24 inches by a mass of broken rocks. The surface is covered with rock fragments, varying from small shale chips to blocks of shaly and massive sandstone. Rock outcrops frequently occur. The type occupies rounded hills and narrow-topped ridges with steep slopes, giving a rough surface from which drainage is excessive. It

is residual soil from the degradation of sandy shales, shaly sandstone, sandstone, and probably some limestone, all of which are more or less ferruginous. It is largely in forests of longleaf pine, with a scattering of deciduous trees.

Chemung stony loam.—The soil is a chocolate-colored fine loam about 8 inches deep, carrying dark-colored shale chips. It is locally known as "black slate land." The subsoil to 36 inches or more is usually similar in color and texture to the soil, though sometimes it is lighter both in color and in texture. The surface is sometimes strewn with flat stones from 6 to 24 inches in diameter, and in places these must be removed before cultivation is practicable. The surface is rough or rolling and the drainage is excellent. The type is derived from the weathering of the slates of the Chemung formation. Oaks and locust thrive. Little of the area of this soil is in cultivation, but it may be made fairly productive.

Morrison stony loam.—The type consists of reddish-yellow heavy sandy loam to loam soil, resting upon a subsoil of reddish-yellow heavy clay loam to sandy clay. Both soil and subsoil contain large quantities of iron-cemented sandstone fragments of varying size. On some of the higher ridges these are so numerous that the type approaches Rough stony land in character. The topography is sharply rolling to hilly, with steep slopes. The soil is derived from the sandstones of the "barrens" region. It is principally forested with chestnut, pine, and oak.

Chandler stony loam.—The soil is a light-brown, grayish, or yellowish stony silty loam to fine sandy loam 3 to 6 inches. The subsoil consists of a yellow or reddish compact silt loam or clay loam, becoming heavier with depth to 24 inches, where a mass of broken rock is encountered. Large quantities of rock fragments of all sizes occur on the surface and through the soil. The surface is rolling to hilly and the drainage is usually good. This type is derived from metamorphic rocks of schistose structure and very fine sandy texture, and in places approaching a serpentine. The type is mostly covered with oaks and has low productiveness when cleared.

MISCELLANEOUS MATERIALS.

TABLE XCV.—*Area and distribution of the miscellaneous materials.*

Kind of material.	State and area.[1]	Acres.
Rough stony land	Ala. 3, 6, 10, 12, 17, 18, 22, 27; Ark. 1, 2; Ky. 2, 6; Ohio 6; Pa. 1, 2, 3, 5; Tenn. 4, 10; Va. 9; W. Va. 2, 3, 4, 5, 6.	1,388,480
Steep broken land	Pa. 5; W. Va. 6	55,488
Rock outcrop	Ala. 17; N. Y. 5; N. C. 2, 11, 14, 22; S. C. 3; Tenn. 11; Va. 3	47,809
Madeland	Pa. 3	448

[1] For key to numbers in this column, see p. 253.

Rough stony land.—Under this heading have been classed areas so stony and broken as to be nonarable, although permitting timber growth and use for pasture. These areas frequently consist of steep mountain ridges, bluffs, or narrow strips extending through definite soil types. They differ from Rock outcrop in that they support vegetation of economic value and from the stony loams in being nonarable.

Steep broken land.—This includes areas over which the topography is so steep that it is impossible to carry on cultivation. The soil, which is often a silty or heavy loam, varies in depth from a few to about 10 inches. The color ranges from brown to light brown. The subsoil usually contains considerable clay, enough to make it a clay loam, and in some instances almost a clay. Scattered upon the surface and throughout both soil and subsoil are found fragments of shale and sandstone, and often the solid rock is reached at a depth of a few feet. The soil is residual and derived from the weathering of soft marly and sandy shales. Fine-grained sandstones, which occur interbedded with the shale, also enter into its formation. On account of its topography the type should, as far as is practicable, be seeded to grass and used as pasture or be allowed to grow up in forest.

Rock outcrop.—This term is used to designate areas consisting of rock ridges, exposed rock outcrops, or accumulations of stone entirely unfit for cultivation and incapable of becoming agricultural land.

Madeland.—Areas are occasionally encountered where filling has taken place over considerable tracts. The arrangement of the materials in these places is artificial and does not fit into any soil classification. In many instances such areas are extensive, and although they are usually of no present agricultural value, they are usually represented by a color in the maps.

SUMMARY.

There is among the sands no soil of special value in this province and no representative of the fine sand group whatever, so far as the survey has extended, which has covered 10,158,817 acres.

Of the sandy loam group there have been mapped 989,805 acres, or 9.7 per cent of the area surveyed, and of the fine sandy loams 510,976 acres, or 5 per cent, which, where topography is favorable, are adapted to truck and fruit crops and to light general farming.

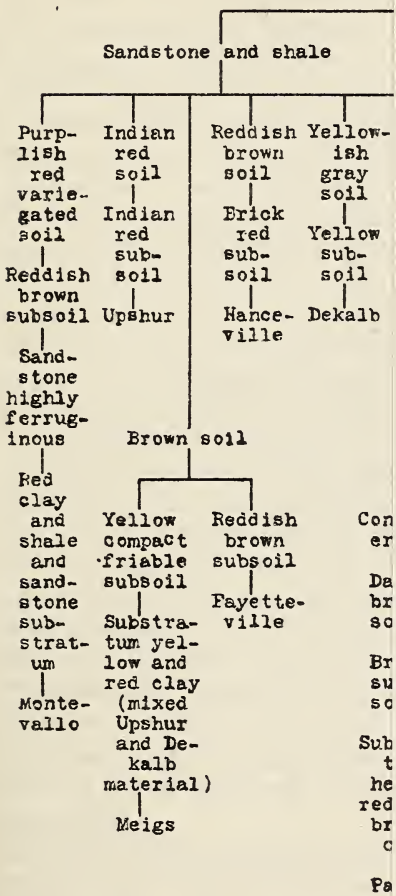
There have been mapped of the loams (including shale loam and black loam) 1,938,498 acres, or 19.1 per cent of the area, containing some of the more desirable soils for general farm and fruit crops, where the topographic position allows such use.

There have been surveyed 1,227,264 acres of silt loams, or 12.2 per cent; 1,482,768 acres of clay loam, or 14.6 per cent; and 609,025 acres of the clays, or 5.9 per cent of the area surveyed. These groups are adapted, where not too steep, rough, and broken, to the heavier types of general farming.

There have been mapped 3,400,481 acres, or about 33.5 per cent of the area, which have been thrown into a class of subordinate soils and of miscellaneous material which on account of topography or exceedingly stony character have very little value for agricultural crops.

The classification of the soils of this province is shown in the diagram, figure 14, facing page 206.

Key to the


Sandstone and shale
Purplish red variegated soil
Reddish brown subsoil
Sandstone highly ferruginous
Red clay and shale and sandstone substratum
Montevallo
Indian red soil
Indian red subsoil
Upshur
Reddish brown soil
Brick red subsoil
Hancock ville
Yellowish gray soil
Yellow subsoil
Dekalb
Brown soil
Yellow compact friable subsoil
Substratum yellow and red clay (mixed Upshur and Dekalb material)
Meigs
Reddish brown subsoil
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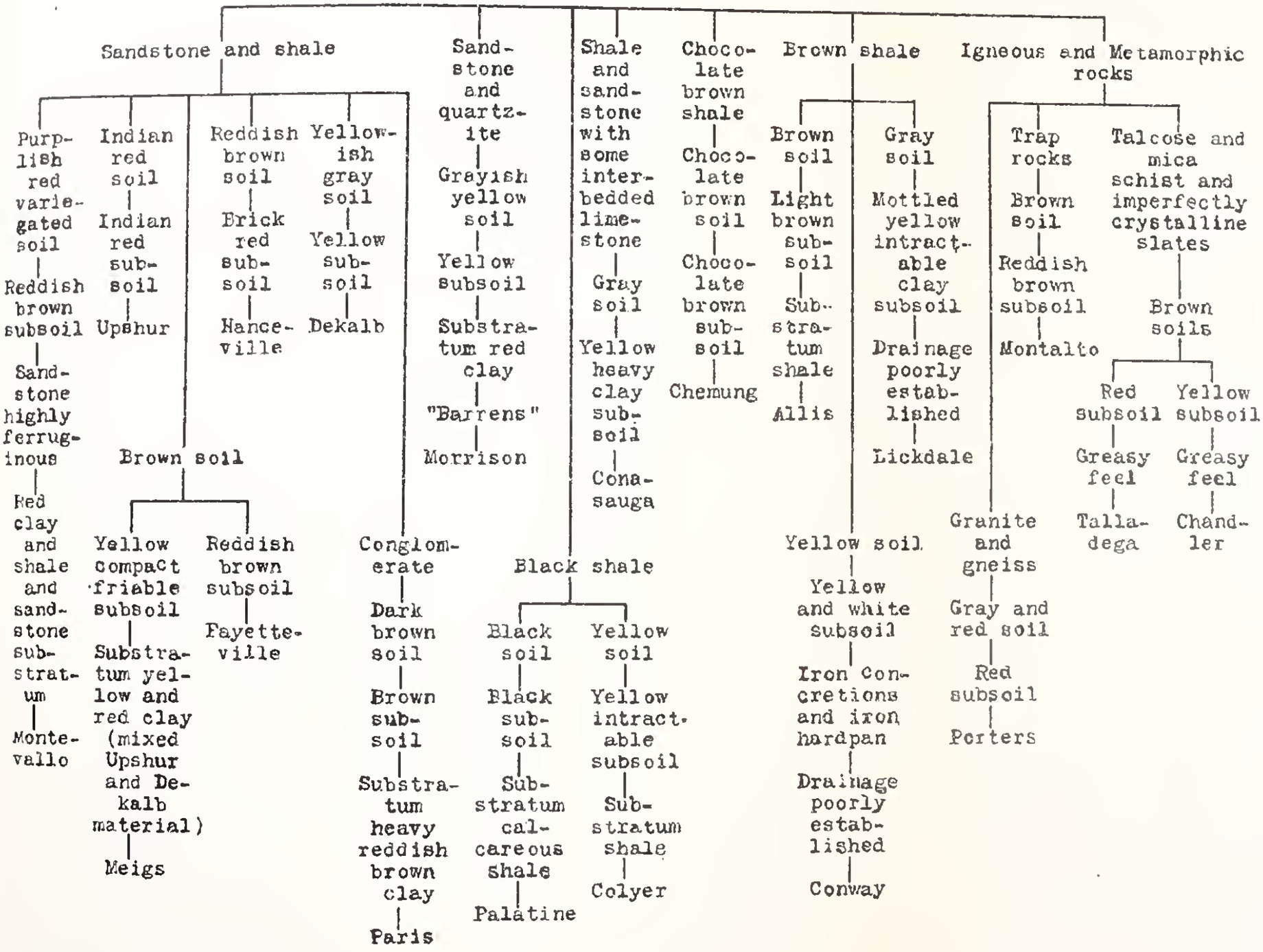
Key to the Soils of the Appalachian Mountain and Plateau Province



SOILS OF THE RIVER FLOOD PLAINS PROVINCE.

The material composing the soils of the River Flood Plains Province has been derived through the carrying power of the streams and rivers from all the other provinces, and the soils as such are young and over about 32.8 per cent of the area are yet unformed. For example, of the total area of 12,756,177 acres surveyed there are 1,222,760 acres of Swamp and 2,967,503 acres of Meadow which are so immature that drainage for the most part is not yet established, the material which ultimately will constitute the soil has not all been deposited, and weathering influences have hardly been effective. The soils of this province as a rule are not weathered as much as upland soils, and this gives them a more loamy character, which, together with their lower situation, causes them to be more retentive of moisture and, group for group, more productive than upland soils. As will be seen from the descriptions, where the lighter soils are low lying and the drainage not thoroughly established a heavier type of farming may be carried on than on the same type or a soil of similar texture where the drainage is more thoroughly established.

Another peculiarity of this province is that it has practically no sandy soils. The reason for this seems to be that while the rivers and streams have a great carrying capacity for soil material they have very little assorting power for the coarser soil particles, which, if separated at all from the finer earth, lie in the bed of the stream and are mapped, when the river changes its course, as Riverwash. Some 30,080 acres of such material have been encountered in this province.

The dominant groups of soils are the fine sandy loam, loams, and silt loams, probably much as they are picked up by the streams from the upland, and the clays which are undoubtedly segregated by the rivers by being floated off to the shallow quiet areas where they in time subside.

The sandy soils found so extensively developed in the Atlantic and Gulf Coastal Plains Province and the Glacial Lake and River Terrace Province are of minor importance in this province. In the former provinces they are undoubtedly due to wave action of the lakes and ocean, which can agitate, but not transport, the coarse particles and which can both agitate and transport through suspension the finer silt and clay.

Of the area surveyed, about 4 per cent varies in grade from sand to sandy loam, 20 per cent is fine sandy loam to loam, 19 per cent is

silt loam, and 26 per cent is clay loam or clay, while the remainder, constituting about 31 per cent, is represented by subordinate phases and by material of little agricultural value and unformed soils, such as Swamp and Meadow.

The use of these soils is therefore dominantly a heavy type of general farming, with canning crops on the loams and comparatively little opportunity for the early truck crops. This is brought out very strikingly in figure 15.

As already pointed out the soils of this province are derived more or less directly from the other soil provinces, the materials of which give the alluvial soils different characteristics over different regions. Thus the soils of the Congaree series are derived mainly from the Cecil soils of the Piedmont Plateau province; the soils of the Huntington series are derived from material of the Appalachian Mountains and Plateau province, particularly the plateau soils; the soils

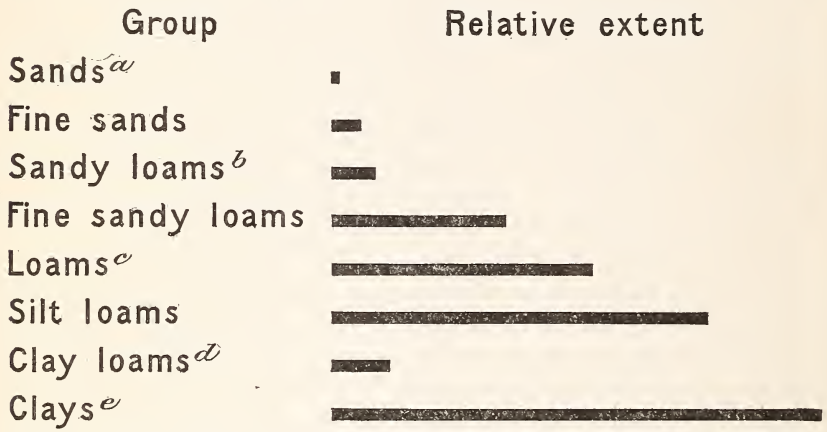


FIG. 15.—Diagram showing the relative extent of the important groups of soils in the River Flood Plains province. a. Including the coarse sand phase. b. Including the gravelly sandy loam phase. c. Including the gravelly loam and shale loam phases. d. Including the silty clay loam phase. e. Including the silty clay phase.

of the Miller series are derived from the material of the Permian Red Beds of the Southwest; the soils of the Ocklocknee series are derived directly from Coastal Plain material; the dark soils of the Wabash series and the light soils of the Waverly series are derived directly from the Glacial and Loessial material, deposited under different conditions; and the Wheeling series is derived from the material of the feebly glaciated areas of the Glacial province.

THE SAND GROUP.

But four types of soil of sandy texture have so far been mapped in the River Flood Plains province. These are all inextensive types and have no marked influence on the agriculture of the region.

TABLE XCVI.—*Area and distribution of the sands.*

Name of soil.	State and area.[1]	Acres.
Kalmia sand	Ala. 1, 2, 8	27,200
Myatt sand	Ala. 2, 8	5,184
Wickham sand	Va. 6	4,416
Ocklocknee sand	Ala. 22	960

[1] For key to numbers in this column, see p. 253.

Kalmia sand.—The soil, to an average depth of 10 or 12 inches, is a grayish or brownish medium to coarse sand. Uncultivated areas usually are dark in color in the first few inches, owing to a rather high content of organic matter. The subsoil consists of a yellowish loose sand to loamy sand. The type occurs on level or slightly undulating stream terraces lying above normal overflows. The material was deposited from overflow water before the stream channels were lowered to their present levels. The soils should be used for the production of early vegetables under intensive systems of manuring.

Myatt sand.—The soil grades from a dark-gray loamy sand at a depth of 4 to 5 inches into a light-gray loamy sand, which becomes heavier with depth until the subsoil proper is encountered at a depth of 18 to 20 inches. The subsoil is a moderately stiff plastic sandy loam to sandy clay mottled gray, red, and yellow. The type occurs as low-lying poorly drained areas upon the higher stream terraces. When drained and carefully treated oats, corn, and forage crops do well. When thoroughly drained it should be used for early truck crops.

Wickham sand.—The soil is a dark-brown to yellowish-brown coarse sand from 16 to 26 inches deep, generally coarser in texture and lighter in color below 14 inches. The subsoil is a reddish-brown or yellowish incoherent sandy loam, which grades at from 28 to 40 inches into a coarse, gravelly material. The type occurs along the rivers, occupying level or slightly sloping terraces. The drainage is good and in some areas of the coarser phase it is excessive. It is essentially an early truck soil and should be used as such when transportation facilities and market demands will permit.

Ocklocknee sand.—The soil to a depth of 8 inches is a dark-gray or light-brown medium to fine sand, rendered somewhat loamy by organic matter. The subsoil consists of medium to fine sand varying in color from light gray to yellow. It occupies a level position 10 to 15 feet above the river, but may be overflowed at times. It is fairly well drained and should be used for cabbage, onions, and other heavy truck crops.

COARSE SAND PHASE.

TABLE XCVII.—*Area and distribution of the Kalmia coarse sand.*

Name of soil.	State and area.[1]	Acres.
Kalmia coarse sand	Ala. 2	5,184

[1] For key to number in this column, see p. 253.

Kalmia coarse sand.—The soil is a light colored rather loose coarse sand. The subsoil is a gray to pale yellow coarse sand having about the same texture as the soil. The type occupies second terraces. Its moisture conditions are chiefly controlled by elevation, the nearness of the water table to the surface insuring a fair supply of moisture in flat areas and depressions and along the foot of slopes. Vegetables and forage crops do fairly well where the soil is liberally manured.

THE FINE SAND GROUP.

While a larger number of types of fine sandy texture is found in the River Flood Plains province the total area is yet inconsiderable, and though influencing the agriculture locally they are not important from an economic point of view.

TABLE XCVIII.—*Area and distribution of the fine sands.*

Name of soil.	State and area.[1]	Acres.
Myatt fine sand	Ala. 2, 5	67,520
Miller fine sand	Ark. 3; La. 3; Tex. 20, 21, 26	66,944
Kalmia fine sand	Ala. 8	20,416
Wabash fine sand	Ind. 1; Okla. 1	16,064
Huntington fine sand	Ala. 3; Ark. 1	5,376
Chastain fine sand	Ala. 2	4,672
Lintonia fine sand	Ill. 3, 7; Mo. 7	4,352
Cahaba fine sand	Ala. 2, 15; Miss. 2	4,288
Wheeling fine sand	Ohio 6; W. Va. 3	3,264
Ondawa fine sand	N. Y. 14	2,176
Teller fine sand	Okla. 2	1,344
Yazoo fine sand	La. 5	768

[1] For key to numbers in this column, see p. 253.

Myatt fine sand.—The type consists of 6 to 10 inches of gray or drab fine sand occasionally underlain by a mottled gray and yellow silty fine sand extending to a depth of 20 inches. Below this the subsoil varies from a mottled gray and yellow silty fine sand to silty clay. The soil may be darkened by large amounts of organic matter. It occurs as rather high banks along the streams. The natural drainage is poor and for this reason but little of the soil is in cultivation.

Miller fine sand.—The soil consists of a loose, loamy, gray to reddish-gray fine sand, resting on a loose fine sand extending to a depth of several feet. It is usually well drained. The higher lying areas are well adapted to fruit, especially peaches and to medium early vegetables. The lower lying areas not so well drained, give low yields of corn and cotton.

Kalmia fine sand.—The soil is a grayish to light-brown fine sand, averaging 5 or 6 inches in depth. The subsoil is a yellowish fine sand which usually becomes lighter in color below 30 inches. The content of very fine sand is relatively high in both soil and subsoil, on which account the entire soil mass is inclined to compact. The type occupies the higher bottom land lying mainly above the line of normal overflow. The soil is easily cultivated, and under proper management gives better yields than somewhat similar upland fine sand types. Corn, forage crops, melons, potatoes, and a number of other vegetables do well.

Wabash fine sand.—The type consists of a loose fine sand 3 feet or more in depth. The soil proper, which is from 6 to 8 inches deep, ranges in color from light-gray to a brownish-gray. The subsoil has a yellowish or light-brown color and is less coherent than the soil. The type is particularly adapted to early vegetables.

Huntington fine sand.—The type consists of a dark reddish-brown loamy fine sand, overlying a reddish-brown fine sand or fine sandy loam. The material is of recent deposition and the areas are still subject to overflow. The soil is too light in texture for general farm crops and without expensive reclamation not well enough drained for truck crops. It is best used for hay and pasture.

Chastain fine sand.—The soil is a light-gray fine sand of low organic matter content. The subsoil is a gray fine sand, usually faintly mottled with yellowish or brownish colors and water-soaked in the lower portions. The type occupies first bottoms lying at a somewhat higher elevation than meadow and averaging much more uniform in textural characteristics. It usually supports a rather scattered growth of pine. The soil has a poor, lifeless appearance and is of little agricultural value.

Lintonia fine sand.—The type consists of a dark-gray to brown fine sand, which at a depth of 10 to 12 inches is underlain by grayish to light-brown fine sand. It occupies second terraces, characterized by billowy topography. It has good drainage, and lies mainly above normal overflow. The material is derived from loessial uplands. The yields of ordinary farm crops are light. Strawberries and other small fruits and truck find this soil well suited to their requirements.

Cahaba fine sand.—The soil, to a depth of from 10 to 12 inches, consists of a grayish-brown loamy fine sand. This is underlain by a reddish-brown or dull-red loamy fine sand, extending to a depth of

30 inches or more. Between 30 and 40 inches a stiff reddish-brown clay may be encountered. Mica flakes are present in both soil and subsoil. The type occurs mainly as long, narrow ridges in the second bottoms of the large streams in the Gulf States. It is open and loose in structure and somewhat droughty. It is adapted to early truck crops under intensive culture.

Wheeling fine sand.—The soil to a depth of about 11 inches is a brown incoherent fine sand. The subsoil to a depth of more than 3 feet is a brownish-yellow sand of practically the same texture as the soil, becoming slightly lighter in color as depth increases. The type occupies gently rolling to rolling areas and is composed of earlier deposits of the Ohio River, which, later, have been subjected to the action of wind, its undulating surface being due to soil drift. The best use for this soil is the growing of potatoes, watermelons, tomatoes, strawberries, and blackberries.

Ondawa fine sand.—The soil, from 4 to 6 inches deep, is a light-brown to yellowish fine sand. The subsoil has the same texture as the surface soil, though usually somewhat lighter in color. The type occurs as a deposit from flood waters, either in slightly undulating areas from moderately swift currents or as small deltas built out on the food plains by small streams coming down from sandy soils of the higher terraces or uplands. It is always of recent or present alluvial origin. The type is adapted to corn, potatoes, and early truck crops.

Teller fine sand.—The soil, to a depth of about 10 inches, is a fine sand, containing considerable organic matter, which gives it a gray color. The subsoil, to a depth of 36 inches or more, is similar to the soil in texture; but, lacking the organic matter, it has a yellow color. In some areas of the type, lying in river bends, the soil is light red in color, and there is no perceptible change between the soil and subsoil. The soil is well adapted to potatoes, melons, and other early truck crops and to fruit.

Yazoo fine sand.—To a depth of 36 inches this soil is a gray, incoherent sand, possessing a uniformly fine texture. While the surface is occasionally found to contain a small amount of organic matter the material usually shows an incoherent structure throughout the profile. The type occurs in relatively small disconnected areas along the immediate banks of the Mississippi, and is formed where recent breaks in the levee result in a sudden checking of the swifter currents with consequent deposition of the coarser of the suspended soil particles. The type is not at present used for agricultural purposes.

THE SANDY LOAM GROUP.

The sandy loams as a group are adapted to vegetables for medium early maturity under given climatic conditions. Also to melons and

early fruit. They are also adapted to the lighter farm crops, under the lightest system of farming. They mature the earliest crops of cotton, which is a decided advantage in districts infested with the boll weevil.

TABLE XCIX.—*Area and distribution of the sandy loams.*

Name of soil.	State and area.[1]	Acres.
Yazoo sandy loam	Ill. 2, 9, 10; Ind. 8; Kan. 1; La. 6, 9; Miss. 14, 15	97,083
Congaree sandy loam	Ala. 7	43,648
Myatt sandy loam	Ala. 1; Ga. 12	36,032
Cahaba sandy loam	Ala. 15, 25	15,680
Kalmia sandy loam	Ala. 1	8,704
Bastrop sandy loam	Tex. 3	7,680
Amite sandy loam	La. 11	7,232
Wabash sandy loam	Ind. 10; Ohio 7	6,624
Huntington sandy loam	Ala. 12; Pa. 3	6,400
Wickham sandy oam	Va. 6	5,120
Trinity sandy loam	Tex. 12	2,688
Altavista sandy loam	Va. 4	1,088
Aroostook sandy loam	Me. 1	960
Cumberland sandy loam	Ky. 3	896
Wheeling sandy loam	W. Va. 2, 6	768
Tyler sandy loam	W. Va. 4	448

[1] For key to numbers in this column, see p. 253.

Yazoo sandy loam.—The type consists of a gray to brown fine, sandy loam, 6 to 12 inches deep, underlain by a lighter colored fine, sandy loam. It has been deposited by streams, usually upon a clay foundation, which in some cases comes to within 12 inches of the surface. The type occupies low, flat ridges, forming front lands near stream courses in river bottoms. The soil is adapted to and can be most profitably used for truck crops. In addition to this it is, in the South, a fair cotton soil and in the North a fair corn soil, producing moderate yields and early crops in both cases.

Congaree sandy loam.—The soil consists of a grayish-brown to reddish-brown sand to light sandy loam 8 to 12 inches deep. The subsoil is a dark-gray to brown or reddish-brown sandy loam, often mottled with yellow or brown. There may be some variation in the subsoil in the form of an occasional bluish color or mottling and layers of sand or sandy loam alternate with layers of loam or silt loam. The type occupies first bottoms and is derived largely through wash from the Cecil soils. It is subject to overflow. In dry years, or when protected from overflow, corn, oats, sugar cane, sorghum, and certain vegetables do well.

Myatt sandy loam.—The type consists of a dark-gray medium to fine sandy loam, overlying grayish material varying from heavy sandy loam to sandy clay. At a depth of about 3 feet the material passes into a stiffer and more plastic substratum. The type occurs on the river terraces in poorly drained, flat, or depressed areas. It is a

cold-natured soil, very difficult to handle in its natural condition. When properly drained and cultivated vegetables do fairly well. Johnson and Bermuda grasses yield well. Corn, oats, and sugar cane give fair returns.

Cahaba sandy loam.—The soil consists of from 8 to 15 inches of sandy loam and is underlain to a depth of 36 inches or more with a fine sandy clay subsoil, brown in color. The color of the soil is usually brown or light brown, tending toward a dark gray in the lower depressions, where the texture becomes rather more silty. The type occurs mainly as second terraces, varying in width from one-fourth to 1 mile. The surface is usually flat, but the drainage is generally adequate. It is sufficiently elevated above the streams to be overflowed only in seasons of unusually high water. The soil is naturally quite productive and well adapted to truck crops for the medium early markets and to cotton. On the more elevated areas small fruits and peaches do well.

Kalmia sandy loam.—The soil is a gray to brown sandy loam of medium texture, overlying a yellowish to slightly reddish sandy clay more or less mottled. It occurs on the first and second terraces along the Alabama River and some of its tributaries and is sometimes inundated. It requires considerable drainage. It is best suited to corn and grass, though sometimes used for cotton. If properly drained and protected from overflow it would be adapted to vegetables.

Bastrop sandy loam.—The soil to a depth of from 10 to 24 inches is dark-brown to reddish-brown sandy loam of rather coarse texture, becoming lighter in color with depth. This is underlain by a yellowish coarse sandy loam, coarse sand, or stratified gravel. Generally considerable gravel is distributed throughout the soil profile. The type occupies strips along river and stream bottoms and is generally subject to overflow. It is otherwise usually well drained. The principal crop is corn. The soil is also well suited to melons, sweet potatoes, cabbage, and other truck crops.

Amite sandy loam.—The soil to an average depth of about 10 inches varies from a brown or reddish-brown sandy loam to a loamy sand of the same color. The subsoil varies from a heavy red sandy loam to a sandy clay. The surface is gently rolling and the type is sometimes spoken of as "second bottom" or "hammock lands." It is sedimentary in origin. The soil is adapted to corn, cotton, oats, sweet and Irish potatoes, and sugar cane, and is also desirable for truck crops.

Wabash sandy loam.—The soil to a depth of from 12 to 24 inches consists of a dark-brown to reddish-brown sandy loam of rather coarse texture, becoming lighter in color with depth. This is underlain by a yellowish coarse sandy loam, coarse sand, or stratified gravel. Generally considerable gravel is distributed throughout the

soil profile. The type occupies strips along river and stream bottoms and is generally subject to overflow. It is usually well drained. The principal crop is corn. The soil is also well suited to melons, sweet potatoes, cabbage, and other truck crops.

Huntington sandy loam.—The soil, which has a depth of 6 to 8 inches, is a dark-brown to black loam to sandy loam. The subsoil is a drab to black heavy silt loam or clay loam. Both soil and subsoil carry varying quantities of waterworn gravel. The type has been formed from material washed from the limestone, sandstone, and slate uplands and deposited in the first bottoms of streams. It is adapted to the general farm crops, grass doing particularly well. It is also adapted to the heavier truck crops, such as cabbage and onions, and with better drainage could be used for the lighter truck crops.

Wickham sandy loam.—The soil is a reddish-brown or brown light friable sandy loam ranging in depth from 10 to 26 inches. The subsoil is a reddish sandy loam or loam, sometimes containing considerable mica, grading into a heavy sandy loam or sandy clay, which also is micaceous. The type occupies terraces, parts of which are overflowed. The surface is level or nearly so, but the drainage is fairly good. This is a very desirable soil for light, general farming and for trucking.

Trinity sandy loam.—The soil to an average depth of about 12 inches consists of a dark-brown sandy loam to heavy sandy loam. The subsoil is quite variable, but usually consists of dark-brown to black loam to sandy clay. The type occurs in stream bottoms, generally near the outer margins where there has been more or less accumulation of material from the adjacent uplands. The main portion of the component material is derived from the calcareous prairies. Drainage is good except for occasional overflows. Cotton, corn, sugar cane, forage crops, and a number of vegetables do well.

Altavista sandy loam.—The soil is a gray sandy loam with an average depth of about 10 inches and carries a fair percentage of rounded pebbles and cobbles scattered over the surface and throughout the soil. The subsoil is a mottled yellow and red clay loam, which in the lower portion grades into red clay occasionally slightly mottled with yellow. The type occupies the more gradual slopes of valley walls adjacent to stream bottoms and occasionally rather indistinct old terraces. Former river action contributed a portion of the component material while a portion appears to have been washed down from contiguous slopes. Part of the soil and most of the subsoil material seems to be of residual origin. Tobacco, corn, wheat, oats, and grass are grown with very fair results.

Aroostook sandy loam.—To a depth of 6 to 12 inches the soil consists of a brown or yellowish-brown medium to fine sandy loam. The subsoil is a grayish-black or greenish-gray medium sand, con-

taining small particles of quartz, calcite, and mica, but consisting principally of dark-colored shale, slate, and sandstone fragments. Pockets of a light-colored silty sand are of frequent occurrence in the subsoil. At about 36 inches a rather impervious compact stratum of clay is encountered. On the upland side the type frequently grades slowly into the Caribou loam. The type occupies level or ridgy second terraces. It maintains a fairly good supply of moisture, but some crops, such as oats and grass, are apt to suffer in prolonged droughts. It is used for potatoes, oats, and grass, producing moderate yields. Other vegetables could be successfully grown.

Cumberland sandy loam.—The soil consists of a brown mellow loam. It is underlain by limestone at depths of 3 feet or more. The subsoil is a light-brown loam to fine sandy clay. The type occupies nearly level to gently rolling second terraces, and has good drainage. It is quite productive, being especially suited to corn, grain, and a number of vegetables.

Wheeling sandy loam.—The soil consists of about 8 inches of light-brown sandy loam, resting upon a rather incoherent yellowish sandy loam or sand, which extends to a depth of 3 feet or more. Scattered upon the surface and disseminated through the soil and subsoil are sometimes found numerous quartz pebbles. The type has a gently rolling topography. Practically the whole of the type so far mapped is devoted to the growing of apples, for which crop it is best adapted.

Tyler sandy loam.—The soil, to an average depth of about 10 inches, consists of a brown to dark-brown medium rather heavy sandy loam of quite uniform characteristics to a depth of at least 3 feet. The type occupies second bottoms along the larger streams, and has been derived through wash from nearby upland areas of sandstone soil. It lies above the level of the normal overflows. While not naturally a highly productive soil, it is susceptible of improvement. The average yield of corn is about 25 bushels, but much larger yields are secured under proper management. Fair yields of wheat, oats, and buckwheat are secured. Sweet potatoes and truck crops, such as tomatoes, asparagus, onions, lettuce, and cabbage, do well. Certain varieties of apples do very well and good yields of strawberries are secured.

GRAVELLY SANDY LOAM PHASE.

TABLE C.—*Area and distribution of the Holston gravelly sandy loam.*

Name of soil.	State and area.[1]	Acres.
Holston gravelly sandy loam	Ala. 6, 12	10,624

[1] For key to numbers in this column, see p. 253.

Holston gravelly sandy loam.—This is a brown medium to fine sandy loam about 10 inches deep. The surface is strewn with rounded quartz, chert, and sandstone gravel. The subsoil is a yellowish fine sandy loam or clay loam containing considerable fine gravel. The surface is nearly level to somewhat rolling, and knolls occur on the high terraces where the type is developed. The Holston gravelly sandy loam is above overflow and was formed in Lafayette or early Columbia time when the land occupied a lower position than at present. The type generally overlies the Conasauga formation consisting of shale with thin interbedded strata of limestone. The soil is of rather low agricultural value.

THE FINE SANDY LOAM GROUP.

The soils of this group as a class are the best types for light general farming and are well adapted to the medium late truck crops, giving good yields and good quality of these products.

TABLE CI.—*Area and distribution of the fine sandy loams.*

Name of soil.	State and area.[1]	Acres.
Miller fine sandy loam	Ark. 3; La. 3, 10, 12; Okla. 1; Tex. 2, 10, 21, 26	233,024
Cahaba fine sandy loam	Ala. 1, 2, 3, 14, 26; Miss. 2, 8; S. C. 7	117,568
Ocklocknee fine sandy loam	Ala. 3, 14, 22	96,000
Myatt fine sandy loam	Ala. 2, 5, 8; Fla. 1, 6; La. 10; Miss. 8, 10	83,904
Wabash fine sandy loam	Ind. 8, 10; Minn. 1; Nebr. 6; Okla. 1	61,760
Kalmia fine sandy loam	Ala. 1, 2, 3, 8	44,480
Holston fine sandy loam	Ala. 6, 10, 12	43,776
Huntington fine sandy loam	Ala. 6, 10; Ark. 1; Pa. 5, 8; W. Va. 2, 6	38,528
Austin fine sandy loam	Tex. 22, 28	32,576
Bastrop fine sandy loam	Tex. 3, 28	32,320
Congaree fine sandy loam	Ga. 9; N. C. 9; S. C. 10; Va. 4	32,000
Yazoo fine sandy loam	La. 5; Miss. 4	30,464
Chastain fine sandy loam	Ga. 7, 11	28,928
Lintonia fine sandy loam	Ind. 2, 3; Ky. 5	28,416
Toxaway fine sandy loam	N. C. 11, 22; Va. 9	25,152
Genesee fine sandy loam	N. Y. 2, 5, 9	20,992
Waverly fine sandy loam	Ill. 1; Ind. 2, 3, 8; Ky. 5; Miss. 3	18,176
Amory fine sandy loam	Miss. 8	15,744
Teller fine sandy loam	Okla. 2	11,712
Brennan fine sandy loam	Tex. 14	11,584
Osage fine sandy loam	Mo. 3	11,520
Cumberland fine sandy loam	Ala. 27; Ky. 3	5,696
Moshannon fine sandy loam	Pa. 3	3,584
Wheeling fine sandy loam	Ohio 6; W. Va. 3	3,328
Schuylkill fine sandy loam	Pa. 2	2,880
Trinity fine sandy loam	Tex. 1	1,600
Sarpy fine sandy loam	Mo. 4	960

[1] For key to numbers in this column, see p. 253.

Miller fine sandy loam.—The type consists of a brown or grayish-brown fine to very fine sandy loam, from 12 to 24 inches deep, underlain by a heavy red fine sandy loam or sandy clay. In local areas the soil material extends to a depth of 3 feet. This type is formed by the reworking of material derived originally from the Permian Red Beds. The higher areas are seldom, if ever, overflowed, and the type is otherwise well drained, except in small local areas. It is a good soil for corn and cotton, and is also well adapted to truck and fruits.

Cahaba fine sandy loam.—The soil, which has a depth of 8 to 12 inches, is a yellowish-gray to brownish-gray fine sandy loam, and overlies a yellowish to reddish-brown heavier fine sandy loam subsoil, which is often mottled below 24 inches with light gray. The type occupies the older and higher wide terraces along the larger streams in the Gulf States. The topography is level to gently undulating, and the drainage is usually fairly good. The larger proportion of the type is above possibility of overflow, though some of it is inundated for short periods in years of excessive flood. In Alabama, Georgia, and parts of Mississippi large areas of this type are under cultivation, and it forms one of the most important soils for light general farming and the heavier types of truck. It averages about one-half bale of cotton and 20 bushels of corn to the acre, but under intelligent management these yields can be greatly increased.

Ocklocknee fine sandy loam.—The type consists of a light-brown or gray fine sandy loam about 10 inches deep, underlain by a light gray or mottled fine sandy loam or loam. It occupies level or gently sloping bottoms. Generally the drainage is quite poor. Corn is a profitable crop, and cotton does well on the better drained areas. With more efficient drainage late crops of truck could be produced.

Myatt fine sandy loam.—The soil is a gray sticky fine sandy loam, with a depth of 10 inches. The subsoil is a drab or gray silty clay of a tough consistency, usually containing a large percentage of iron concretions. The drab clay is mottled with iron stains. The type occurs on lower hillsides and low-lying bottoms. The latter areas are subject to frequent overflow, and drainage is poor. Very little of this soil has been encountered under cultivation. The natural growth is gum, cypress, and oak, the latter making some very fine timber. The crop yields are poor. With proper drainage and good treatment this soil could be brought to a good state of productivity and be used for light general farming and early vegetables.

Wabash fine sandy loam.—The soil consists of a light-brown to black fine sandy loam about 12 inches deep. The subsoil varies from a fine sandy loam to a fine sand, which is generally dark in color though sometimes changing to yellow at about 24 inches. Frequently

considerable fine rounded gravel is distributed throughout the subsoil. The type occupies flat bottom lands. Some areas produce heavy yields of wheat, oats, and corn, while others, better drained, are better suited to melons, sugar beets, Irish potatoes, and alfalfa.

Kalmia fine sandy loam.—The Kalmia fine sandy loam has a dark-gray to brown fine sandy loam surface soil 15 to 18 inches in depth, overlying a yellowish-gray, mottled, heavier fine sandy loam or sandy clay. The type is alluvial in origin and occupies high first and second terraces along the Alabama River and some of its principal tributaries. The topography is nearly level to gently undulating and, although the land is seldom overflowed, much of it is poorly drained and wet, especially during periods of considerable rainfall. The native vegetation includes water oak, the gums, and hickory. The type is better for corn than for cotton, but for either crop it would be much improved by drainage, and drainage is essential for truck farming.

Holston fine sandy loam.—To a depth of about 10 inches the soil of this type is a grayish to brown fine sandy loam containing considerable silt. This rests upon a yellow heavy fine sandy loam becoming reddish in the lower profile. The type occurs as old terraces high above overflow. Shales and interbedded limestone of the Conasauga formation often underlie this type at no great depth. The topography is level to gently undulating, favoring good natural drainage. The principal crops are cotton and corn. The yields are lower than on continguous first terrace soils.

Huntington fine sandy loam.—The soil is usually a light-brown to dark-brown or nearly black fine sandy loam or silty loam, though where there is more than the average amount of sand present it sometimes may be yellowish gray in color. The subsoil, to a depth of 36 inches is of about the same texture, but lighter in color. In places it contains considerable organic matter. In some instances the upper part of the subsoil has a relatively high content of fine material, but this rapidly decreases with depth until, at about 30 inches, the material becomes a fine sand of loose and incoherent structure. The type occupies bottom lands and owes its origin to sediments carried from adjoining uplands. It is well adapted to light general farming and mid-season truck crops.

Austin fine sandy loam.—The soil is a brownish-yellow or reddish-gray fine sandy loam. There is no marked difference between the soil and the subsoil, and the latter often extends to a depth of many feet without change. From the surface to a depth of about 3 feet the color gradually becomes lighter. Soil of this type occurs in very level areas, with an elevation of from 40 to 60 feet above the present level of the streams. It is well drained and is inclined to be droughty. It is adapted to corn, cotton, fruit, and vegetables. Con-

siderable sorghum fodder is grown upon the first-bottom areas, and alfalfa would also do well where drainage conditions are favorable.

Bastrop fine sandy loam.—The type consists of 6 to 12 inches of dark-brown medium to fine sandy loam, underlain by a brown fine sandy clay that becomes lighter in color and heavier in texture with depth. It is an alluvial soil occurring in the Colorado River bottoms and has a comparatively level topography, with characteristic swells and depressions. The drainage is generally good, with the exception of some depressed areas needing surface ditching. It is very seldom overflowed. It is one of the most productive river bottom soils and adapted to a wide range of crops, including cotton, corn, sorghum, oats, alfalfa, and pecans, all of which do well.

Congaree fine sandy loam.—The soil is a brown mellow fine sandy loam 3 feet or more in depth. Some areas tend to become sandier with depth, while in others the reverse is true. In places the type is sometimes modified by colluvial wash from the uplands. The surface is generally level. Areas of this soil occur principally as first bottoms along swift-flowing streams, and are subject to occasional overflow during very wet weather. During the remainder of the year they are sufficiently well drained to produce excellent crops of corn, cotton, sorghum, and grasses. Cotton does best upon the higher and better drained areas.

Yazoo fine sandy loam.—The soil, to a depth of 8 to 12 inches, consists of a brown fine sandy loam, and is underlain to about 24 inches by a brownish-colored compact fine sandy loam. Below 24 inches a bluish-colored clay loam is often encountered. The type occurs as long, low, narrow ridges along the streams and old stream channels. The drainage is good, and it is only in times of the most general inundation of the delta that the type is completely covered with water. Practically all the area of this soil, so far as mapped, is in cultivation to cotton and corn, though it is well adapted to a variety of general farm crops, as well as to fruit and truck crops.

Chastain fine sandy loam.—The Chastain fine sandy loam occurs as broad, flat stream bottoms consisting of a surface soil of grayish and dark-gray fine sandy loam, underlain at from 2 to 4 or 5 feet by a stiff impervious clay, mottled drab, yellow, and red. The Ocklocknee River flats, in which this type is found, are, for the most part, subject to frequent overflows, and none of this land is under cultivation. Along some of the lesser streams the drainage conditions are somewhat better, overflows being not so frequent, and the stiff clay subsoil usually lies farther from the surface. Portions of these better drained stream bottoms could be brought under cultivation and made to produce fair crops of corn.

Lintonia fine sandy loam.—The soil consists of yellowish-brown to dark-brown silty fine sandy loam, averaging about 10 inches in

depth. The subsoil consists of yellow to light-brown silty clay loam. The type occupies second bottoms, and is well drained. It is derived from the loessial uplands, comprising chiefly the Knox and Memphis silt loam. The soil has good structure and is easily maintained in good condition. Wheat, oats, and corn do well. It is particularly adapted to early potatoes and to various truck crops.

Toxaway fine sandy loam.—The soil, to a depth of 8 to 10 inches, consists of a light-brown to dark-brown, mellow fine sandy loam. The subsoil, to a depth of 36 inches or more, is a light-brown or yellowish-brown, loose fine sandy loam. In some areas bordering large streams a considerable quantity of stream gravel is encountered at a depth of about 2 feet. Both the soil and subsoil are very micaceous, and in some instances the proportion of mica present is sufficient to give the soil a smooth or greasy feel. The type occupies practically level areas along creeks and in the oxbows of rivers. Practically all of it is under cultivation. The better drained areas are adapted to corn and hay of the general farm crops, as well as to melons and vegetables.

Genesee fine sandy loam.—The soil consists of a light-brown to dark-brown moderately heavy fine sandy loam from 10 to 20 inches deep. The subsoil has about the same texture as the soil, but usually is slightly lighter in color. There are in places slight variations from the typical, due to local erosion and to deposition of sand and silt over small areas by overflow waters. Streaks of sand and silty material are sometimes encountered in the soil mass. Most of the type is subject to annual or frequent overflow. It is in other respects mainly a well-drained type. It is mellow, friable, and easy to till, and where protected from overflow is admirably suited to corn, oats, clover, and timothy. Cabbage, tomatoes, potatoes, and other heavy truck crops can be made profitable crops.

Waverly fine sandy loam.—The soil to a depth of 15 inches is a light-brown to gray fine sandy loam, the sand content being usually large and of the finer grades. The soil becomes heavier as the depth increases, and at from 15 to 20 inches grades into a brown fine sandy loam, with a larger percentage of silt and clay. The sand content, depth of soil, and size of the sand particles often vary according to location. The type generally occurs as a sandy ridge along streams. Its elevation above the stream assures good drainage. The soil is productive and easily cultivated, and in seasons of average rainfall the crop yields are large. The type is best adapted to corn, melons, early vegetables, and alfalfa. The other crops successfully grown are wheat, oats, potatoes, and tobacco.

Amory fine sandy loam.—The soil to a depth of 6 or 8 inches is a brown fine sandy loam, often approaching the texture of a loam. The subsoil is usually a brown fine sandy clay to a depth of 36 inches

or more, but in places the color varies from yellowish brown to reddish yellow. The color of the subsoil which is intermediate between the red of the Orangeburg and the yellow of the Norfolk is the distinguishing feature. The topography varies from comparatively level to gently rolling and the drainage is generally good. With good management the type can be brought to a comparatively high state of productiveness. Cotton and corn are the chief crops grown. Sorghum, oats, peas, melons, and various vegetables can be successfully grown.

Teller fine sandy loam.—The soil is a fine sandy loam of gray or yellow color and is underlain by a red or yellow heavy fine sandy loam. The type occupies high river terraces and is above the overflow. It is level to gently rolling in topography and has good natural drainage. The principal crops grown are cotton and corn. With favorable climatic conditions peaches do well. Uncleared areas of the type are covered with a thick growth of oak.

Brennan fine sandy loam.—The soil of this type, to an average depth of about 12 inches, consists of a heavy fine to medium sandy loam of a gray to very light-brown color. The subsoil consists of a heavier brown sandy loam, containing a larger percentage of silt and clay and becoming heavier as the depth increases, until in the lower part of the 3-foot section it carries enough silt and clay to make it plastic and sticky when wet and to give it the characteristics of a very sandy clay. The lower portion of the subsoil is hard and compact and is usually so dry that it can be crushed into a fine powder, but when wet it becomes stiff and plastic, and the larger content of silt and clay is very noticeable. Only a very limited acreage is cultivated. During favorable seasons fair yields of cowpeas, corn, and sorghum may be obtained. The greater part of the type is valued as pasture land, inasmuch as it supports a heavy growth of native grasses.

Osage fine sandy loam.—The type is a dark-brown or grayish-brown fine sandy loam containing considerable organic matter and overlying a yellowish-brown or grayish subsoil. It occurs along small streams as first bottoms and is derived from the deposition of stream sediments. It has fair natural drainage and is a very desirable soil for corn and the staple crops.

Cumberland fine sandy loam.—The soil is a light-brown to yellowish silty fine sandy loam 8 to 15 inches in depth. The subsoil consists of a thin layer of yellowish-red to red gritty clay or clay loam, which changes quickly into a dark-red stiff clay. Occasionally rounded gravel occurs on the surface and in the soil. It occupies rolling and sloping terraces along larger streams and has excellent drainage. The subsoil is residual from limestone, while the soil rep-

resents ancient alluvium. It is almost all cultivated to general farm crops and should be well adapted to strawberries and small fruits.

Moshannon fine sandy loam.—The soil, to a depth of 6 to 8 inches, consists of a reddish-brown to Indian-red light to heavy fine sandy loam. The subsoil is usually similar in color to the soil, but is more compact and often coarser in texture. Gravel beds are usually encountered within the soil profile. Rounded gravel is a common constituent of soil and subsoil. The type is derived from the Upshur soils. Fairly good crops of corn are raised. The heavier vegetables do well.

Wheeling fine sandy loam.—This type consists of about 10 inches of brown, loose, fine sandy loam, resting on a yellowish-brown fine sandy loam, which may become slightly heavier at 20 to 30 inches below the surface, though below 30 inches the texture again generally becomes more sandy. It is best adapted to the growing of melons and strawberries. Good crops of wheat, corn, potatoes, and hay are also produced. Small fruits, such as raspberries and blackberries, do well.

Schuylkill fine sandy loam.—The surface soil consists of brown, dark-brown, or black fine sandy loam to light loam 10 inches deep. Where black the color is due in part to an accumulation of coal dust brought down the river from the anthracite region. The subsoil is light-brown fine sandy loam to reddish-brown fine loam, with local color variations of yellow or gray. The subsoil is sometimes micaceous or gravelly. The type occupies first bottoms along the Schuylkill River, and most of it is subject to overflow. Good yields of general farm crops are obtained. When protected from overflow and well drained it should be used for trucking.

Trinity fine sandy loam.—The soil to a depth of about 10 inches is a dark-brown fine sandy loam, usually rather heavy. The subsoil is a brown to black heavy loam to clay. The type occurs in first bottoms usually near the foot of slopes where there has been more or less deposition of material from adjacent uplands. Except for occasional overflows, the type is fairly well drained. The material, particularly the subsoil portion, is derived from the calcareous prairies. Good crops of cotton, corn, forage, and sugar cane are secured.

Sarpy fine sandy loam.—This is a rather silty fine sandy loam to a depth of about 12 inches, where it is underlain by fine sand. It occurs in the bottoms of the Missouri River and upon some of the islands in that stream.

THE LOAM GROUP.

The loams are the general-purpose soils of this province. As a class they are adapted to vegetables which mature late and give heavy yields admirably adapted to canning purposes. They provide medium late fruit. They are also adapted to a rather heavy type

of farming. The group contains the great corn soils of the province. With cotton, they may be expected to produce larger yields of a somewhat later crop than the sandy loam. With this group grass becomes of importance for the pasturage afforded, to supplement the supply of hay and forage. The loams require a moderately heavy farm equipment.

TABLE CII.—*Area and distribution of the loams.*

Name of soil.	State and area.[1]	Acres.
Ocklocknee loam	Ala. 15, 18, 26; Miss. 2, 6, 8, 10, 12	281,152
Wabash loam	Ill. 10; Ind. 3, 5; Mich. 7; Minn. 4; Mo. 8; N. D. 2, 8, 9; Ohio 3, 4, 5, 7, 8, 9; Wis. 3, 4, 6.	237,424
Yazoo loam	Ill. 1, 7, 9; Kans. 1, 4; La. 5, 6, 9; Miss. 4, 14, 15; Mo. 7, 9	203,459
Congaree loam	Ala. 7, 24; Miss. 11; N. C. 4; S. C. 13; Va. 5	153,984
Huntington loam	Ala. 1, 9; Ark. 2; Pa. 5, 8; Tenn. 4; Va. 9; W. Va. 2, 6	97,344
Genesee loam	N. Y. 1, 3, 5, 7, 8, 10, 11, 12; Ohio 2	77,760
Waverly loam	Ind. 8; Tenn. 6, 8	72,768
Cumberland loam	Ky. 2; Tenn. 2, 4, 5; Va. 9	61,184
Bibb loam	Ala. 18; Miss. 10	50,304
Cahaba loam	Ala. 2, 14; Miss. 8	49,088
Miller loam	Okla. 1, 2	37,184
Trinity loam	Tex. 12	25,280
Sanders loam	Tex. 20, 21	17,408
Amite loam	La. 11	16,320
Toxaway loam	N. C. 11, 22	11,328
Sarpy loam	Mo. 1	7,360
Holston loam	Ala. 13; Tenn. 4	7,168
Kalmia loam	Ala. 18	6,784
Elk loam	Tenn. 1	6,144
Holly loam	Tenn. 1	5,952
Wickham loam	Va. 5	5,952
Blanco loam	Tex. 23	5,376
Moshannon loam	Pa. 3	3,968
Jackson loam	Mo. 11	2,304
Franklin loam	Tex. 7	1,280
Aroostook loam	Me. 1	64

[1] For key to numbers in this column, see p. 253.

Ocklocknee loam.—The soil is a brown loam 8 to 24 inches in depth. The subsoil is a grayish clay loam or sandy clay, mottled with brown, yellow, and red. Both soil and subsoil are somewhat variable. The type consists principally of material derived from Susquehanna soils. In some localities it is subject to overflow. The timber growth comprises white and water oak, gum, hickory, magnolia, shortleaf pine, and minor undergrowths. When drained it produces fair crops of cotton, corn, oats, Johnson grass, sorghum, and sugar cane.

Wabash loam.—The soil consists of a light-brown loam about 10 inches deep, often containing a small proportion of sand and in local areas some gravel. The subsoil is usually a heavy brownish-yellow

loam 20 to 40 inches deep, overlying a gravelly loam. The type occurs as first bottoms along rivers and small streams, and much of it is subject to periodical overflow. It is a first-class corn soil, producing from 35 to 60 bushels per acre. More extensive use may and should be made of this type for canning crops, such as sugar corn, green peas, tomatoes, and the like.

Yazoo loam.—The soil consists of a yellow or brown loam or silty loam 6 inches deep. The subsoil is usually a silt loam, but in local areas may be a silty clay or fine sandy loam. The type occupies low ridges in river bottoms, and represents the higher lying areas of fine sediment deposited by inundations. It is a strong cotton soil, producing 1 bale per acre. In northern areas the soil is equally well adapted to corn and wheat. The heavier truck crops as well as fruits do well and canning crops should be much more extensively grown than at present.

Congaree loam.—The soil is a loam from 4 to 8 inches deep. The subsoil is a gray or brown mottled plastic clay, carrying considerable fine sand. Occasionally the soil in small areas is deeper and lighter in texture. This soil occupies the flood plains of creeks and smaller streams, generally contains considerable organic matter, and is subject to overflow. The material is derived chiefly from the Piedmont. It is a good cotton and corn soil and when properly drained is adapted to a wide range of crops.

Huntington loam.—The soil is a brown loam to silty loam usually having a depth of from 10 to 12 inches and underlain by light to dark brown loam, silty loam, or clay loam. A sandy loam sometimes occurs in the lower part of the subsoil. The type is level to slightly rolling and occurs mainly as stream bottom land subject to overflow. It may also be found in small upland depressions. It is best adapted to the production of corn and hay and much of it is used for pasture. The soil is well adapted to truck crops, where highwater is not likely to cause injury, and where drainage is adequate canning crops may be produced.

Genesee loam.—The soil consists of a mellow, friable, brown to dark-brown loam about 8 to 20 inches deep. The subsoil is a fine loam to clay loam ranging in color from light-brown to yellowish-brown. In places a substratum of coarse material is encountered below 3 feet. The type mainly occupies level first bottoms subject to overflow. Artificial drainage is generally necessary to insure the best results. In some of the higher valleys and on the higher terraces the type is not subject to overflow and usually is quite well drained. This is an ideal soil for corn, wheat, grass, oats, onions, carrots, and cabbage, when protected from overflow and thoroughly drained. Corn yields from 40 to 80 bushels per acre, oats around

40 bushels, hay 1 to 3 tons, onions from 500 to 800 bushels, and carrots as high as 1,000 bushels per acre. Potatoes and tomatoes do well. Celery, asparagus, beets, and sugar corn are grown with fair success.

Waverly loam.—The type consists of a dark-brown or black loam about 10 inches deep, underlain by a brown to yellowish clay loam or clay. It occurs as first-bottom lands along rivers and creeks. It carries much more organic matter than the Wabash loam. The surface as a rule is flat, though occasionally it may be slightly rolling. Open ditches are frequently necessary to provide adequate surface drainage. The original timber growth consists mainly of gum, sycamore, water oak, beech, and willow. The soil is adapted to corn, wheat, and cotton, as well as to forage crops, according to location, and large yields are secured when no injury is sustained by overflows. As a rule the drainage is not sufficient to allow the highest efficiency of the soil to be realized. When thoroughly drained and protected from overflow it is one of the best soils for cotton in the South, for corn in the Central States, and for wheat in the northern part of this province. It also produces large yields of forage crops and pasture grasses. It is well adapted to the heavier truck crops, especially to cabbage and onions. The soil is not so well adapted to canning crops as others of the group.

Cumberland loam.—The soil is a brown rather mellow loam or slightly sandy loam 6 to 15 inches deep, underlain by a brown to reddish-brown clay loam subsoil. Some rounded gravel occurs in both soil and subsoil. The type occupies second bottoms or high terraces along streams, occurring mainly in the horseshoe bends. The surface is generally rolling and the drainage is excellent. The type is well suited to general farm crops, and is also used for truck crops, small fruits, and orchard fruits.

Bibb loam.—The soil of the Bibb loam to a depth of 8 or 10 inches is a light-gray to white rather compact loam or silty loam. The subsoil is a white or nearly white silt loam to silty clay loam usually mottled more or less with yellowish or brownish colors. The type occupies flat first bottoms and is subject to poor drainage conditions and overflow. The material is derived from Coastal Plains soils. Baking and compacting frequently bring about decidedly unfavorable structural conditions. Wild grasses flourish on this soil, affording excellent grazing. The type is well suited to hay crops. Corn and cotton give only moderate average yields. Ditching is very much needed to insure better drainage. Applications of lime would also improve the condition of the soil.

Cahaba loam.—The soil to a depth of from 4 to 10 inches consists of a gray loam. The subsoil is a brownish to mottled yellow and gray clay loam to clay. The darker gray surface soil and the mottled subsoil are generally found in the lower lying to level areas.

This is a second bottom soil confined to the larger streams of the Gulf Coast States. The topography is undulating to level. The soil in the depressions is usually heavier than on the swells. Drainage varies according to topography, the lower lying areas frequently requiring ditching. The orginal timber growth consists of hardwood and pine. With good drainage it is an excellent soil suited to the production of crops of corn, cotton, and forage.

Miller loam.—The soil is a brown, reddish-brown or red fine sandy loam to silty loam varying in depth from 10 to 16 inches. The subsoil is a red or reddish-brown fine plastic loam to silty clay. The type occurs as stream bottom land and to a large extent is composed of wash from the Permian Red Beds. The greater part of the type is found on upper terraces which represent ancient flood plains, but which are now above all danger of overflow. The principal crops grown are corn, oats, wheat, and cotton. Corn will yield from 40 to 60 bushels, wheat from 30 to 35 bushels, and oats from 40 to 60 bushels per acre. Cotton often yields more than a bale to the acre. Alfalfa does well on well-drained areas of the soil.

Trinity loam.—The soil to a depth of about 12 inches is a dark-brown to black loam or silty loam. The subsoil is a heavy loam to clay loam, somewhat stiff and plastic, and usually dark brown to nearly black in color. The type occurs in the first bottoms of streams as flat areas usually interrupted only by an occasional old stream channel. The material is derived largely from the calcareous prairie formations and contains enough organic matter and lime to constitute a soil of good structure. Some of the type is subject to overflow and poor drainage conditions. In good seasons cotton, corn, and sugar cane do particularly well. The better drained areas are well suited to alfalfa.

Sanders loam.—The soil is a dark-brown, reddish-brown, or gray loam. The subsoil is lighter in color and apparently heavier in texture. The type occurs as narrow strips along the creeks, extending up the edge of the valleys, and frequently has Sharkey clay on the stream sides, which interferes with proper drainage. It is considered a very good corn soil, producing as much as 45 bushels per acre where well drained. It is not considered so good for cotton, producing about one-half bale per acre. The areas generally are in need of drainage.

Amite loam.—The type consists of a brown or light-chocolate colored loam about 8 inches deep, underlain by a yellowish or reddish clay loam subsoil of uniform texture to a depth of 36 inches. It occupies the higher flood plains. It is a good corn soil and is also adapted to cotton, sugar cane, and the heavier truck crops.

Toxaway loam.—The soil, to a depth of 8 to 15 inches, consists of a black, dark-brown or dark-gray loam, containing a relatively large

content of organic matter. The subsoil is a brown or yellowish-brown silty loam or loam. In many places the silty material grades into a yellowish or white silty clay at 20 to 24 inches. Occasionally at 30 inches a highly micaceous fine sandy loam or fine sand is encountered. In some cases the areas have a very gradual slope toward the upland, while in others they appear perfectly flat. A considerable part of the type is subject to overflow at times of high water. Practically all of the type is under cultivation or included in pasture. It is a very productive soil and is especially adapted to corn, grass, and rye. On some parts celery, cabbage, cucumbers, and pumpkins would do well.

Sarpy loam.—The soil is a dark-gray to almost black rather fine textured loam with a depth of from 8 to 12 inches. An exposed surface of the soil when dry has a light-gray color, but upon wetting it becomes almost black. The soil is immediately underlain with a yellowish-gray subsoil, which in texture is generally a very fine sandy loam. There are areas, however, in which the subsoil may be a light fine sandy loam or a silt loam. It occupies the low ridges and higher elevations of the bottoms, rising probably 5 or 10 feet above the neighboring lowlands. Because of its texture and structure, which allow rapid seepage of water, and its elevation, which is sufficient to prevent overflow, it has very good drainage. All general farm crops, including corn, wheat, oats, clover, and alfalfa, do well, and large yields are secured. This soil is also well adapted to all kinds of truck crops for the medium to late markets.

Holston loam.—The soil is a yellowish-gray silty loam or very fine sandy loam, 8 to 10 inches deep, underlain by a yellowish-brown silty clay or very fine sandy clay, slightly mottled with redder colors in the lower depths. The subsoil is free from gravel, but in places the surface is strewn with waterworn gravel. The soil is generally deficient in humus and when dry it has an ashy-gray surface appearance. The type occurs as high terraces, which have been modified by erosion. A large percentage of it is under cultivation, although it is not considered productive. Corn and wheat are the principal crops. Limited areas are devoted to oats, sorghum, cowpeas, hay, and pasturage.

Kalmia loam.—The soil is a light-brown to pale-yellow loam. The subsoil is a yellow compact loam. It is frequently mottled with grayish colors. The type occupies second terraces, and has moderate to poor drainage. Average yields are light. With drainage and liberal applications of manure yields can be materially increased.

Elk loam.—The soil of this type is a brownish-gray, medium-textured loam, 6 to 8 inches deep. This overlies a yellowish-brown heavy fine sandy loam or sandy clay, somewhat mottled below a depth of 2 or 3 feet. Some quartz gravel is occasionally present in the subsoil. The type occurs as second terraces or filled-in and abandoned

channels on the Highland Rim of Tennessee, and is not subject to overflow. It is alluvial in origin, the sediments being derived from limestone and transported only short distances. The soil is principally used for corn, wheat, oats, and grasses. Corn yields 25 to 40 bushels, wheat 10 to 20 bushels, and oats 30 to 50 bushels.

Holly loam.—Dependent upon its position with reference to the streams along which it occurs, the soil of the Holly loam varies from a quite silty to a rather sandy loam, gray to brown in color, and from 8 to 12 inches deep. The subsoil is also variable in color and texture, ranging from a mottled gray silty loam or silty clay to a brownish fine loam or clay loam containing small amounts of chert gravel. The natural drainage is generally poor, overflows are frequent on the lower lands, and the soil is apt to clod when cultivated. The material is derived principally from the Clarksville soils. The agricultural value is inferior to that of the soils of the same texture of the Huntington series. Its best use is for pasturage.

Wickham loam.—The soil to a depth of 10 inches is a yellowish-brown or chocolate-colored loam, resting on a loam of lighter color and slightly heavier texture, which becomes heavier with increasing depth and grades into a clay loam at about 30 inches. Both the soil and subsoil contain numerous fine particles of mica. The type occurs in the form of terraces along stream courses adjacent to the Piedmont Plateau. It is comparatively level in topography, with an occasional slight elevation or very slight depression. It is above the average in productivity for soils of this grade. It is well adapted to and should be used for corn, wheat, oats, and hay.

Blanco loam.—The soil consists of a gray heavy loam about 10 inches deep. When dry and baked a thin gray crust is formed on the surface, but when wet or recently cultivated the surface has a light-brown appearance. The soil grades into a light-brown heavy loam to silt loam subsoil, which gradually becomes heavier as the depth increases and at from 30 to 36 inches changes to a heavy plastic silty loam of a more pronounced brown color than the upper soil. The type occupies almost level areas along river courses. It represents quite recent stream deposits. Its position along stream courses and its level topography make it possible to irrigate a very large part of this type. The soil is well adapted to general farm crops, as well as vegetables, but its limited acreage in any one locality makes it a soil of minor importance. When irrigation is practiced, cotton produces from three-fourths of a bale to 1 bale per acre, and corn from 50 to 60 bushels per acre. Irish potatoes give excellent yields, and sweet potatoes do fairly well. From 3 to 6 cuttings of alfalfa are obtained on irrigated areas, with an average yield of one-half ton per acre each.

Moshannon loam.—The soil is a brownish-red to Indian-red loam 8 inches deep. The subsoil has the same color as the soil, but the

sand content increases with depth. At 30 inches a compact layer of material is frequently encountered, ranging from the fine sandy loam to clay loam. Rounded gravel occurs throughout the soil and subsoil. The type is derived from the Upshur soils. It produces heavy yields of corn, grass, and clover. Wheat and oats do well, but the straw is liable to be rank enough to cause lodging. The better drained areas make good crops of potatoes.

Jackson loam.—The soil is a light-brown loam with an average depth of 14 inches, and grades into a mottled sandy clay or clay subsoil. The type occurs as second bottom, with a gently rolling surface. It produces about 15 bushels of wheat and from 25 to 40 bushels of corn per acre. Onions give large yields. The soil is well adapted to light farm crops and to truck, wrapper tobacco, and peaches.

Franklin loam.—The soil consists of a brown loam with an average depth of 10 inches, underlain by a lighter colored brown loam. The subsoil varies in texture and may be either lighter or heavier than the soil. It has nearly level topography. It is formed largely by wash from hills covered by Lamar loam. Though seldom subject to overflow much of the type needs artificial drainage. With good drainage the soil is fairly well adapted to cotton and corn.

Aroostook loam.—The soil consists of a yellowish-brown to dark-brown loam from 8 to 10 inches deep. The subsoil in the upper 10 inches is a mottled gray to brown silty loam to silt loam and below this a mottled compact silt loam, in which the gray color predominates. The type is inclined to be sticky when wet on account of a relatively high clay content and is locally called "clay land." It occupies terraces at the foot of slopes bordering streams. Oats and grass do well, and potatoes fairly well.

GRAVELLY LOAM PHASE.

The gravelly loam phase of the loam group occupies a comparatively small area in the River Flood plains province. Table CIII shows four types of this phase. The types are somewhat widely distributed.

TABLE CIII.—*Area and distribution of the gravelly loams.*

Name of soil.	State and area.[1]	Acres.
Travis gravelly loam	Tex. 2, 26	25,728
Huntington gravelly loam	Ala. 17; Pa. 3; Tenn. 3, 12	23,552
Wheeling gravelly loam	Ohio 6; W Va. 2, 3, 6	11,712
Cumberland gravelly loam	Va. 9	3,840

[1] For key to numbers in this column, see p. 253.

Travis gravelly loam.—The soil is a coarse sandy loam containing a large quantity of rounded gravel both on the surface and in the

soil. This grades at a depth of 10 to 12 inches into a mass of coarse sand and rounded gravel cemented together by a stiff, sticky red clay. This material at the present time forms a series of terraces on each side of the streams. Many of the rounded pebbles are of quartz and granite. The location of the type, together with the open structure, allows water to seep rapidly through it, so that crops suffer severely from drought. On a few of the more level areas cotton, corn, and oats are grown, but the yields are small. The soil seems best adapted to melons and tree fruits. The soil is at present occupied by a heavy growth of post oak and black-jack oak.

Huntington gravelly loam.—The soil consists of 10 inches of brown loam or silty loam containing a considerable quantity of gravel, and is underlain to about 3 feet by a similar textured, lighter-colored material which contains more gravel. The type is variable in color, texture, and gravel content. In the lower depths a bed of gravel and broken rocks is encountered, and this is frequently cemented together. The type occurs as bottoms along the smaller streams, and usually there is a gentle slope from the streams to the foot of adjacent hills. It is well drained. All of it so far mapped is in cultivation and produces fair yields of corn, wheat, and cotton.

Wheeling gravelly loam.—To a depth of from 8 to 10 inches the soil is a brown gravelly loam. The fine earth varies from a silt loam to a sandy loam. The subsoil to a depth of 3 feet or more is a light-brown or yellowish gravelly loam, the fine earth of which varies from a silt loam to a sandy loam. From 30 to 50 per cent of waterworn gravel, consisting of granite, quartz, quartzite, sandstone, and shale, is found in both soil and subsoil. The topography of the type varies from level to rolling and hilly. The soil is particularly well adapted to watermelons and tomatoes. Of general farm crops it is best adapted to corn. Wheat does fairly well.

Cumberland gravelly loam.—The soil consists of from 6 to 12 inches of grayish to yellowish-gray loam, the texture often approaching a sandy loam. The subsoil is a heavy yellowish loam to clay loam generally grading into a heavier material, with an increasing amount of red coloring, and at from 30 to 36 inches it passes into a yellowish-red to red clay. There is a high percentage of rounded pebbles and cobblestones on the surface and mingled with the soil. It produces good yields of corn, wheat, oats, and grasses.

SHALE LOAM PHASE.

TABLE CIV.—*Area and distribution of the shale loam.*

Name of soil.	State and area.[1]	Acres.
Genesee shale loam	N. Y. 5	640

[1] For key to number in this column, see p. 253.

Genesee shale loam.—The soil is a heavy silt loam, brown to dark-brown in color, having a depth of 6 to 8 inches. The subsoil is of the same character and slightly lighter in color. Both soil and subsoil contain from 25 to 50 per cent of small thin shale fragments. It is particularly adapted to the production of hay, oats, and corn.

THE SILT LOAM GROUP.

The silt loams are generally heavy soils to work and require a heavy farm equipment. In the northern areas they are better adapted to wheat than to corn. They are generally well adapted to hay and dairying. Truck and fruit crops mature late, and in the more northern areas are adapted to storage for the winter markets. In the southern areas corn and cotton give large yields, and grass and grain crops do well when the soils have adequate drainage.

TABLE CV.—*Area and distribution of the silt loams.*

Name of soil.	State and area.[1]	Acres.
Wabash silt loam	Ill. 2, 3, 5, 6, 8, 9; Ind. 1, 3, 7, 8, 10; Ia. 2, 4; Kans. 2, 5, 6; Ky. 5; Minn. 1; Mo. 1, 4, 5, 6, 8, 9, 10; Nebr. 3, 5, 6; Okla. 1.	801,756
Waverly silt loam	Ark. 4; Ill. 1, 2, 4, 7, 9; Ind. 1, 2, 3, 9; Ky. 1; La. 5; Miss. 3, 4, 9; Mo. 7; Tenn. 8.	445,760
Huntington silt loam	Ala. 3, 6, 10, 12, 13, 17, 19, 27; Ark. 1, 2; Ky. 2, 3, 6; Mo. 12; Ohio 6; Tenn. 2, 3, 7, 9, 11, 12; Va. 9; W. Va. 4.	382,338
Lintonia silt loam	Ill. 9; Ind. 8; Ky. 5; Miss. 4, 9, 14, 15	117,556
Osage silt loam	Mo. 2, 3	82,624
Cahaba silt loam	Ala. 1, 3; Miss. 8	63,040
Miller silt loam	La. 3, 4; Tex. 20, 21, 25, 26	54,208
Ondawa silt loam	N. Y. 4, 14	34,240
Pledger silt loam	Tex. 4	31,872
Neosho silt loam	Kans. 1, 4	30,739
Ocklocknee silt loam	Miss. 2, 8	29,952
Genesee silt loam	N. Y. 5	26,112
Tyler silt loam	W. Va. 2, 3, 4	24,704
Kalmia silt loam	Ala. 22	17,216
Laredo silt loam	Tex. 5,14	16,768
Sarpy silt loam	Mo. 1, 4	15,872
Sanders silt loam	Tex. 9, 21, 24	15,680
Biscoe silt loam	Ark. 4	12,992
Wheeling silt loam	Ohio 6; W. Va. 2, 3	10,944
Bibb silt loam	Ala. 3	9,088
Collins silt loam	Ark. 4	8,576
Bastrop silt loam	Tex. 3	6,080
Moshannon silt loam	W. Va. 4	5,248
Catalpa silt loam	Miss. 10	5,056
Birdsboro silt loam	Pa. 2	3,840
Cumberland silt loam	Tenn. 12	3,584
Holston silt loam	Ala. 12; Va. 9	2,944
Aroostook silt loam	Me. 1	2,432
Abernathy silt loam	Ala. 9	832

[1] For key to numbers in this column, see p. 253.

Wabash silt loam.—The type consists of a dark-brown to black silt loam about 12 inches deep, underlain by a heavy silt loam of lighter color. Sometimes, however, the dark color extends to a depth of 3 feet or more. The type occupies stream bottoms subject to overflow, and is often poorly drained. When well drained it is a productive soil, producing heavy crops of corn and grass and fair yields of small grain, potatoes, sugar beets in northern areas, and cotton in the southern areas. It is adapted to late and heavy truck crops.

Waverly silt loam.—The soil is a light-brown to white silt about 10 inches in depth and is underlain by a grayish or yellowish silt loam of heavier texture. The type occupies bottom lands and marshy depressions. Corn is the principal crop grown with cotton in the southern areas.

Huntington silt loam.—The soil, to a depth of about 12 inches, is a yellowish-brown to brown silt loam. The subsoil may be a somewhat lighter brown clay loam in which the sand content becomes slightly greater as depth increases, or its texture may differ little from that of the soil. The lower portion of the subsoil is often fine sand or fine sandy loam grading into coarse water-bearing gravel. The type is level to slightly rolling in topography and is subject to overflow. It occurs along the stream courses in the Allegheny Plateau. When well drained and protected from overflow it is well adapted to corn, potatoes, hay, and the late and heavy truck crops. Sorghum and alfalfa do fairly well in certain parts of the area. The principal crops grown at present are corn, potatoes, and hay. Wheat is also sometimes sown on the higher levels, where there is less danger from overflow.

Lintonia silt loam.—The soil consists of a brown silty loam 10 inches deep. The subsoil is a yellow silt, quite uniform in color and texture, sometimes underlain by clay at a depth of 3 to 4 feet. The soil lacks plasticity, and has rather a mealy character. Areas of this type are found along the foot of bluffs and as narrow strips in stream valleys, generally adjacent to the higher lying Memphis silt loam. The soil is mainly colluvial in origin, representing reworked material of the Memphis silt loam. It is rarely inundated, but is subject to addition of material from the uplands during winter rains. This is a good cotton soil and is also well adapted to market gardening and fruit culture. In the northern areas it produces corn, wheat, hay, oats, and potatoes.

Osage silt loam.—The soil consists of a gray or grayish-brown silt loam, which gradually becomes lighter in color and usually heavier in texture with depth until at 3 feet it is a drab or gray silty clay loam. It constitutes the lighter colored alluvial soil derived from the dark-colored prairie soils of the western uplands. When properly drained it is a very productive soil for heavy general farm crops.

Cahaba silt loam.—The soil is a yellowish-gray silt loam from 8 to 10 inches in depth, underlain by a yellow to brownish-yellow subsoil of rather variable textural characteristics, though usually a silt loam or loam. Gray mottling often appears in the deeper subsoil. The type usually occurs as broad, high terraces along the larger streams in the Gulf States. It is above overflow from all ordinary freshets. The topography is level to gently undulating and except in depressions drainage is fairly good. With good drainage and improved methods of cultivation and rotation a bale or more of cotton and upwards of 40 bushels of corn per acre may be counted on, with a moderately heavy farm equipment.

Miller silt loam.—The surface soil consists of a brown, red, or light-colored silt loam, varying in depth from 6 to 20 inches. The subsoil is a heavy red silt loam, often grading into a lighter-colored fine sandy loam at 2 to 3 feet. The material is derived from the Permian Red Beds. This soil occupies level or slightly rolling areas and is frequently subject to overflow. It is a friable, productive, and easily cultivated soil, and is usually well drained. It is a productive soil adapted to cotton, corn, alfalfa, and sugar cane, and also to late vegetables, and truck crops.

Ondawa silt loam.—The type consists of a dark-brown, mellow silt loam about 12 inches deep, underlain to a depth of 3 or 4 feet by a subsoil of the same silty material, though of a gray to pale-brown or yellow color. There is usually a deep subsoil of gravel which often comes to the surface in local areas of small extent. The type always occurs on first bottoms or the level floor of stream valleys and is derived from the fine alluvial materials deposited by flood waters. It is an excellent soil for grass, both for hay and pasturage, also for corn, oats, potatoes, and the heavy late truck crops.

Pledger silt loam.—The soil to a depth of 10 to 14 inches consists of a black silt loam. The subsoil is a brown silt loam to silty clay, usually of a reddish or yellowish shade. The type occurs as slight ridges in river bottoms often along the stream courses as narrow strips of well-drained soil merging into the low, flat, poorly-drained Trinity clay or Miller soils. The type is a very productive soil and is considered the best agricultural soil of the river valleys owing to its well-drained condition. It is locally called "peach land," owing to a common growth of wild peach tree (Laurocerasus Caroliniana or Prunus Caroliniana). The type owes its origin to high-water deposition of dark-colored material, largely from the Black Prairies of Texas over reddish alluvial material from the Red Beds region. This type is limited in extent and highly prized for corn, cotton, cane, and potatoes. Pecan, oak, ash, and wild peach constitute the principal timber growth. The soil has the feel of a silt loam, but small areas are found which analyze as light as a fine sandy loam.

Neosho silt loam.—The soil to a depth of 8 inches is a light-colored, somewhat ashy silt loam containing small and varying amounts of fine and very fine sand. The subsoil from 8 to 25 inches is a drab very compact and impervious silty clay, locally known as "hardpan." The type occurs principally upon terraces, lying from 5 to 15 feet above the level of the river bottoms. Its elevation is sufficient to insure it against overflow and to afford fair surface drainage, although the underdrainage is usually deficient. Deep plowing or subsoiling and the addition of organic matter would greatly improve its moisture-holding capacity. It is best adapted to wheat and grass, but corn and oats do well, when the season is neither extremely wet nor dry.

Ocklocknee silt loam.—The soil consists of a dark-gray to a yellowish-gray silt loam, having a depth of about 9 inches. The subsoil is a yellowish clay loam grading into a rather heavy mottled gray and brown clay. On the higher swells the material is lighter in texture, approaching sometimes a fine sandy loam, while in depressions the heavier phase is encountered. The subsoil is more mottled in the level and depressed areas. The type occupies the first bottom of streams in the Gulf Coastal Plains. It is subject to overflow, and much of it is rather poorly drained. Where properly drained and handled it produces fine crops of corn and cotton. It is a heavy soil to work and requires a rather heavy farm equipment.

Genesee silt loam.—The soil consists of a brown to dark-brown silt loam from 10 to 12 inches deep. The subsoil is a brown silty loam to silt loam, sometimes resting on lighter material at lower depths. The type occupies level stream bottoms and is mostly subject to overflow. Artificial drainage is necessary with the greater part to insure good results with crops. This soil when properly drained is fairly productive, giving yields of 30 to 75 bushels of corn and 75 to 150 bushels of potatoes per acre. Sugar beets do well, yielding as high as 18 tons per acre. Oats succeed quite well and wheat fairly well. Peppermint, beans, late vegetables, especially cabbage for winter use, are successfully grown.

Tyler silt loam.—The soil consists of 10 inches of a dark-gray or brown mellow silt loam, underlain to 15 inches by a lighter gray or yellow silt loam. From 15 to 36 inches the subsoil varies from a yellow or yellow-brown compact clay loam to a heavy plastic clay or a yellowish, sticky sandy clay. It is often mottled gray and brown, has a soapy feel, and contains numerous mica flakes. It is generally underlain by rounded or flattened sandstone gravel, beneath which lies bed rock, upon which the soil was deposited by streams. The type is confined to second bottoms of tributary streams of the Ohio River. Drainage conditions are poor, and the type is locally called "crawfish

land." It is not well adapted to wheat, but fair yields of corn and oats are secured. It is largely in meadow or pasture.

Kalmia silt loam.—The soil consists of a yellowish-brown to pale-yellow, rather compact, silt loam. The subsoil is a yellow, compact silt loam, frequently mottled with grayish colors. The type occupies second bottoms, and the drainage condition is moderately good to poor. Crop yields are light. It is difficult to maintain in good condition of tilth unless supplied with organic manures.

Laredo silt loam.—The soil, to a depth of about 12 inches, consists of a gray to very light brown silt loam, which usually contains a considerable amount of fine and very fine sand in the upper 6 to 10 inches. The subsoil, to a depth of 36 inches, is composed of the same material as the soil, but usually contains less fine sand and is slightly lighter in color. The topography, as a whole, is nearly level. A comparatively large percentage of the type is farmed, and the greater proportion of the cultivated area is under irrigation. When irrigated it produces very profitable yields of all crops grown, but on the unirrigated areas the yields are usually light and the crops are often a total failure. The principal crops are onions, cotton, sweet potatoes, and cowpeas. Beets, turnips, and strawberries are very successfully grown. It is probably the best soil in the province for Bermuda onions.

Sarpy silt loam.—The soil is a dark-gray to almost black silt loam, rather heavy in character and clodding to some extent under cultivation. At an average depth of about 10 inches there is a fairly sharp change in color to a slightly lighter shade of gray, without much difference in texture. At about 18 inches, or slightly deeper, a more marked change in color and texture occurs, the material being a light gray and usually containing noticeably more very fine sand. The type is found in the broad bottoms of the Mississippi, Missouri, the lower Platte, and some of the other larger rivers of the Central States. It occupies low ridges or slight elevations, and probably represents the former sites of sand and silt bars or banks of the meandering channels of the rivers, which subsequently to the shifting of the streams have received the deposits of silt which now form the surface soil. On account of its relatively higher elevation and the loose structure and coarser texture of the lower subsoil the type is comparatively well drained and is very productive of the ordinary farm crops, such as corn, wheat, oats, clover, alfalfa, etc. It is subject to inundation only in times of unusually high floods.

Sanders silt loam.—The soil, to an average depth of 12 inches, is a dark-colored or nearly black compact silt loam. There is frequently a mottling of brown and drab immediately beneath the surface soil. Pockets of sand or a mantle of sandy material may occur

almost anywhere. Though the subsoil is variable it is generally a dark-gray or brown mottled with drab silt loam passing into a brown fine sandy loam in the lower depths. It occupies the bottoms along lower creek courses. It is subject to overflow, but still makes good crops of corn, cotton, Johnson grass, and Bermuda grass. Heavy yields of sugar cane are also obtained.

Biscoe silt loam.—The type consists of 8 to 12 inches of a loose chocolate-brown silt loam, underlain to a depth of 36 inches by a yellow or brownish-yellow silt loam. The subsoil is quite light to a depth of 24 inches, and often at from 24 to 36 inches is a heavy silt loam, sometimes slightly mottled with gray. The surface in many places is rather sandy, the sand being from fine to medium in texture. The type occupies gently rolling areas and is fairly well drained. The whole of it is never overflowed, but during times of high water parts are inundated. It is well adapted to cotton and corn, which are the leading crops. With proper drainage and thorough cultural methods it is an excellent soil for the heavier and later truck crops. It is also, under similar conditions, well adapted to alfalfa.

Wheeling silt loam.—The soil to a depth of about 12 inches is a mellow, brown silt loam. The subsoil from 12 to about 16 inches is usually a somewhat lighter brown, compact, but friable silt loam, and from this depth to the lower limit of the profile a brownish-yellow friable silt loam is found, the structure being somewhat more compact as depth increases. It occurs in level or gently rolling areas along river courses. The type is particularly well adapted to potatoes, but also produces good crops of wheat, corn, and hay. Tomatoes are also grown very profitably upon this type. Alfalfa has been grown to some extent, and it would seem that this crop should prove very profitable on a more extensive scale.

Bibb silt loam.—The soil is a white silt loam which, when dry, has a floury feel. The subsoil, which is reached at a depth of about 10 to 15 inches, is a white, compact silty clay, slightly mottled with streaks of yellow and brown. Iron concretions are frequently encountered in the subsoil. The type occupies first bottoms and is poorly drained. The material is derived through wash from the Coastal Plains soils, principally the Norfolk and Susquehanna. Its agricultural value is low.

Collins silt loam.—The type consists of about 24 inches of a brown silt loam, underlain to a depth of 36 inches by a gray silt loam. It occupies narrow bottom lands along small streams and is very nearly level in topography. It is profitably cultivated, although occasional crops are lost on account of overflow. The principal crops grown at present are cotton, corn, and potatoes.

Bastrop silt loam.—The soil is a heavy brown silt loam 12 inches deep, and the subsoil to a depth of 36 inches is a brown silt loam to silty clay, quite compact and somewhat darker in color than the surface soil. Disseminated through soil and subsoil are an abundance of small shell fragments, which occasion the local name of "shell land." It has a tendency to bake and is somewhat difficult to handle. The soil occupies first terraces where the topography is rather level, but above the overflow mark. As a rule the drainage is very good. This soil is largely devoted to cotton and corn, though some oats, hay, and alfalfa are produced. Melons and potatoes give excellent yields. The pecan is indigenous. While the soil is naturally productive and gives good returns, much larger yields could be secured with heavier farm equipments than are generally found.

Moshannon silt loam.—The soil, to an average depth of 10 inches, consists of a reddish-brown to Indian-red silt loam. The subsoil is very similar to the soil in texture and differs from it mainly in the closer structure and brighter red or Indian-red color. The type occupies first bottoms and is derived largely through wash from the Upshur soils. It is on the average somewhat more productive than the Huntington silt loam, possibly on account of a higher content of lime as the result of the presence of a larger proportion of material washed from the calcareous shales giving rise to the Upshur soils. The type is inclined to clod to some extent.

Catalpa silt loam.—The soil, to a depth of 8 to 20 inches, is a dark-brownish or brownish-gray fine heavy loam to clay loam. The subsoil varies from a jet-black tough clay in the smaller bottoms to a dark-grayish mottled clay in the larger bottoms. Local modifications have been caused by washings from Selma chalk. Drainage is essential to cultivation. When this is provided, the type is a very valuable soil for heavy general farming.

Birdsboro silt loam.—The soil is a yellowish-brown silt loam 10 inches deep, with local variations caused by more than a normal content of fine sand. The subsoil consists of yellow or yellowish-brown silty clay loam. A few rounded stones and some small gravel are strewn on the surface and mixed with soil and subsoil. The type occupies second terraces on the Schuylkill River and is not subject to overflow. It is a fairly good general farming soil, and is also used to some extent for trucking, to which it seems to be adapted.

Cumberland silt loam.—This soil is a light-brown to yellow silt loam 6 to 12 inches deep, frequently containing a considerable quantity of fine sand and some waterworn gravel. It consists of sediments deposited along streams when they occupied higher elevations than at present. The material for the most part was probably of local

origin, having been washed down from the near-by hills. As the streams deepened their channels this material became a portion of the upland, subject to erosion. It is characterized by low, rolling hills and gently sloping forelands, extending back from the streams to the higher elevations occupied by residual limestone soils. Its position of 50 to 100 feet above the river insures ample surface drainage. It retains sufficient moisture for successful plant growth and is a rich, productive, easily cultivated soil.

Holston silt loam.—The soil, to a depth of 10 inches, is a gray to yellowish-gray silt loam. The subsoil is a yellowish to reddish-yellow clay loam, passing below 36 inches into a clay of the same color. A few rounded cobblestones occur on the surface. Soil of this description occurs along the Roanoke River, but is residual soil from underlying sandstone and shaly formations. A part is utilized for pasturage, and cultivated areas give good yields of general farm crops.

Aroostook silt loam.—The soil to a depth of about 10 inches is a dark-brown friable mellow silt loam. The subsoil is a lighter-brown silt loam, slightly mottled with gray and chocolate brown. It usually becomes sandier with increase in depth, passing into a stratum of dark-colored gravel at from 3 to 5 feet. The type occupies first bottoms, and is subject to overflow, but this usually comes in the spring, so that crops are seldom injured. The soil is very productive, giving large yields of potatoes of excellent quality adapted to winter use.

Abernathy silt loam.—The soil of this type is a reddish silt loam about 8 inches deep; the subsoil a mottled gray and brown somewhat heavier material. The type occurs in depressions in the uplands, where, in many instances, ponds or lakes have formerly stood, or along short, narrow, sluggish streams. The subsoil may in some instances be residual from the underlying limestone. When well drained fair yields of grain and forage crops are secured.

THE CLAY LOAM GROUP.

A number of soils in this group occur in the Flood Plains Province, but none of them are very extensive, and for this reason the group has very little influence on the agricultural production. Certain of the types, however, as will be brought out in the detailed description of the soils, are very valuable for the growing of certain special crops.

TABLE CVI.—*Area and distribution of the clay loams.*

Name of soil.	State and area.[1]	Acres.
Waverly clay loam	Ala. 14; Ill. 7; Ind. 2, 8; Mo. 7	105,280
Ocklocknee clay loam	Miss. 2, 8, 12	40,512
Wabash clay loam	Ind. 3; Ia. 3; Mo. 1; N. Dak. 2	35,520
Huntington clay loam	Ark. 2; Pa. 3	19,008
Sarpy clay loam	Mo. 1; Nebr. 5	15,360
Myatt clay loam	Miss. 10	4,096
Wickham clay loam	Va. 6	2,176
Sanders clay loam	Tex. 9	1,664
Genesee clay loam	N. Y. 5	960
Holly clay loam	Ky. 3	896
Laredo clay loam	Tex. 14	704
Cumberland clay loam	Va. 9	192

[1] For key to numbers in this column, see p. 253.

Waverly clay loam.—The soil, to a depth of about 6 inches, is a heavy light-brown to grayish clay loam, often containing small iron concretions scattered over the surface and through the soil. In texture it becomes heavier with depth and grades into a very heavy clay containing a large percentage of silt. At a depth of from 12 to 20 inches the subsoil is a sticky, mottled clay, usually containing small iron concretions, becoming stiffer and more tenacious as the depth increases. There is apparently little organic matter in the soil except in swampy areas. The compact nature of the soil, together with its level topography and low-lying position, often makes drainage very difficult. This type is formed largely through the reworking by streams of the loessial material from the uplands. The soil is best adapted to clover, timothy, and redtop. The other crops grown are tobacco, wheat, and corn, the yields depending upon thoroughness of drainage and cultivation. Where no drainage is practiced the land is either covered with a growth of scrub oak or used exclusively for pasture. It is a heavy soil to handle and requires a heavy farm equipment.

Ocklocknee clay loam.—The soil is a brown or dark-brown clay loam from 8 to 18 inches in depth, averaging about 10 inches. The subsoil is a brownish, drab, or gray clay loam or silty clay loam to a depth of 36 inches or more. Sometimes beds of sand are encountered at 3 feet and below. The type occurs as level or gently undulating first bottoms along streams, and is derived directly from Coastal Plain material. The natural drainage is poor, and crops frequently are damaged by floods, which occur annually. This is a difficult soil to handle and requires a heavy farm equipment and thorough drainage. When drained it is well adapted to corn and hay crops. It is less well adapted to cotton, although excellent yields may be obtained.

Wabash clay loam.—The soil typically consists of a dark-gray to black silty clay loam, from 8 to 18 inches deep, though it varies locally from a heavy silt loam to a silty clay. The surface is frequently marked by small mounds rising from 1 to 3 feet above the general level. On the mounds the soil is generally a silt loam, between them a silty clay, and on their slopes a silty clay loam. The subsoil is a gray or yellow-gray, plastic, heavy silty clay loam or silty clay. The type occupies level or slightly rolling bottom lands with fair drainage conditions. It is best adapted to the production of pasture grasses, and much of the type is used for this purpose Under ordinary management the tilled portions produce only fair yields of general farm crops. Much larger yields are obtained where artificial drainage is employed.

Huntington clay loam.—The soil to a depth of 8 to 10 inches is a clay loam of drab to dark-gray color. The subsoil is a drab to yellow slightly plastic silty clay loam or clay. Yellow and drab mottling is quite common in the poorer drained areas. The type represents the wash from nearby shale, sandstone, and limestone formations. It occurs principally as first bottoms and is subject to overflow. A small proportion lies above overflow, upon indistinctly developed second terraces. It is a heavy soil to handle and is generally in need of drainage. It is adapted to corn, oats, wheat, and hay, the yields being larger with improved drainage and thorough cultivation.

Sarpy clay loam.—The soil is a stiff, waxy, gray to black clay loam from 12 to 24 inches deep, with an average depth of about 20 inches. The subsoil consists of gray or yellow fine silty sand. This is a bottom land type occupying depressed areas and generally requiring artificial drainage. It is of recent alluvial formation and is undergoing some change at the present time. When drained it makes excellent corn soil, the average yield per acre being about 50 bushels. It is used to some extent for alfalfa where not overflowed, and excellent yields are secured.

Myatt clay loam.—The type consists of 3 to 5 inches of brown or brownish-gray silt loam to clay loam, passing into a light-gray mottled plastic silty clay subsoil which has the appearance of carrying considerable fine sand. Under cultivation the soil has a tendency to clod. It occurs as low, level areas generally bordering stream bottoms, and only a few feet above overflow. The natural growth consists of post, red, Spanish, pin, water, and white oaks, hickory and pine. A few areas are cultivated, and except during wet seasons the yields are large. Cotton, corn, oats, and hay are the crops best adapted to this land.

Wickham clay loam.—The soil consists of about 6 inches of pale-yellow or gray loam passing into a yellow clay loam which extends

to a depth of 12 inches. The subsoil varies from a slightly friable to a stiff yellow, olive, or mottled clay, containing considerable fine sand and fine flakes of mica in its lower depths. The type occupies level or slightly rolling terraces and is generally well drained. The soil is very productive, yielding in good seasons from 40 to 60 bushels of corn, from 15 to 30 bushels of wheat, 50 or more bushels of oats, and from 1 to 2 tons of hay per acre.

Sanders clay loam.—The type consists of 12 inches of dark-brown clay loam, underlain to 3 feet or more by a gray or yellowish silty clay. The type occurs in limited areas along the edge of the bottoms, and its formation is due in part to flood action and in part to wash from the adjacent prairie soils. The drainage is usually fair. Well adapted to cotton and corn and when artificially drained to alfalfa.

Genesee clay loam.—The soil is a heavy clay loam, dark in color, having a depth of about 10 to 12 inches. The subsoil is a heavy silty clay, bluish to drab in color. The type is poorly drained and is best used for hay and grazing.

Holly clay loam.—The type consists of a brown to gray clay loam soil to a depth of 10 inches grading into a stiff peculiarly mottled clay, the main color being drab or blue, streaked with blue or gray. This material extends to a depth of 3 feet or more and at about 10 feet assumes a uniform deep-blue color. It is a first bottom soil generally poorly drained and occasionally subject to overflow. It is used to some extent for corn, wheat, and grass. It is very much in need of drainage and lime.

Laredo clay loam.—To an average depth of 10 or 12 inches this type consists of a heavy light-brown silty loam which contains enough clay to make it sticky and tenacious when wet and to cause it to bake and sun-crack on drying. The soil grades into a brown silty loam of slightly heavier texture which rapidly becomes heavier as the depth increases, until at an average depth of about 20 inches it changes to a stiff, compact, silty clay of a dark-brown color. The type occupies shallow depressions adjacent to the rolling upland. A large proportion of the type is farmed and the greater part of the cultivated area is irrigated. It is well adapted to the production of Bermuda onions. Corn, cabbage, beets, sorghum, cowpeas, and sweet potatoes are all successfully grown. Cowpeas do exceedingly well on both irrigated and unirrigated areas.

Cumberland clay loam.—The soil to a depth of 8 to 12 inches is a brownish to grayish-brown clay loam. The subsoil is a reddish-brown to reddish heavy clay loam to clay to a depth of 36 inches or more. The soil carries small amounts of waterworn pebbles. The surface is gently rolling and the drainage is good. It occupies old river terraces. Good yields of corn are secured, though it is largely utilized as pasture.

SILTY CLAY LOAM PHASE.

Table CVII shows three types of soil in the silty clay loam phase. These soils, though not widely distributed, are productive when properly drained.

TABLE CVII.—*Area and distribution of the Wabash silty clay loam.*

Name of soil.	State and area.[1]	Acres.
Laredo silty clay loam	Tex. 5	33,216
Osage silty clay loam	Mo. 3	20,416
Wabash silty clay loam	Mo. 1	2,752

[1] For key to numbers in this column, see p. 253.

Laredo silty clay loam.—The soil is a dark-brown to black heavy silty loam to silty clay loam, with an average depth of 12 inches. The subsoil, from 12 to 36 inches, is a light-brown to drab silty clay loam, becoming lighter colored with depth. Both soil and subsoil are sticky and plastic when wet and bake on drying. Areas of this soil occur along old stream channels and have a nearly level topography, though they suffer little from lack of drainage. The soil is derived from alluvium deposited along abandoned channels of the Rio Grande River. It supports a heavy growth of mesquite and cactus. When cultivated it produces excellent crops of corn, cotton, sugar cane, and vegetables, especially under irrigation. Small accumulations of alkali occur in depressions and very flat areas.

Osage silty clay loam.—The soil is a brown or gray clay loam containing a high percentage of silt and extending to about 20 inches in depth. The subsoil is a light-brown or drab clay loam, slightly heavier in texture. The soil contains considerable organic matter, and is friable and easily worked. It occurs as level areas along streams, and is alluvial in origin, being still subject to overflow. The water drains away quickly, however, and the type is well adapted to the production of corn and sorghum. Alfalfa is also grown to a limited extent.

Wabash silty clay loam.—The soil, with a depth of 15 inches, is a dark-gray to almost black silty clay loam. The subsoil consists of a lighter gray clay, containing considerable silt and fine sand. The type occurs in broad bottoms, and is usually closely associated with other members of the Wabash series, especially the Wabash silty clay. It occupies positions somewhat more favorable to drainage than the Wabash clay. In its occurrence in the Missouri Valley it is a good soil for general farm crops, especially for corn and wheat.

THE CLAY GROUP.

The clays are more or less difficult soils to handle, and require the heaviest farm equipment. When properly drained and cultivated they are the most productive soils for hay and forage crops, and in northern areas should be used for the most intensive form of dairying.

TABLE CVIII.—*Area and distribution of the clays.*

Name of soil.	State and area.[1]	Acres.
Sharkey clay	La. 5, 6, 9, 10; Miss. 4, 14, 15; Tex. 12, 15, 20	842,620
Trinity clay	Ala. 14, 24; Miss. 2, 8, 10; Tex. 1, 2, 3, 4, 7, 8, 9, 10, 12, 18, 21, 23, 24, 26, 28.	570,432
Wabash clay	Ill. 2, 4, 7, 9, 10; Kans. 1, 4; La. 5, 6, 9, 11; Miss. 4, 14, 15; Mo. 1, 4, 7, 8, 9, 10; Nebr. 5; N. D. 2; Ohio 10; Okla. 2.	419,915
Miller clay	Ark. 3; La. 3, 4, 12; Okla. 1; Tex. 4, 21, 26	269,504
Ocklocknee clay	Ala. 2, 3, 5, 11; Fla. 2; Ga. 1; Miss. 2, 6, 10	226,432
Waverly clay	Ark. 4; Ind. 2, 8; Ky. 1, 5; Ohio 10	201,152
Cahaba clay	Ala. 11, 15, 24; Ga. 5; N. C. 6	104,128
Congaree clay	Ala. 21, 24; Miss. 7; N. C. 6, 18; S. C. 11	37,408
Cameron clay	Tex. 5	27,072
Sanders clay	Tex. 9, 18, 24	26,304
Huntington clay	Ala. 17; Ark. 1	23,552
Osage clay	Mo. 2	23,232
Calhoun clay	Ark. 4	12,672
Bastrop clay	Tex. 3	12,352
Elk clay	Ala. 16	11,840
Bibb clay	Miss. 10	7,360
Laredo clay	Tex. 5, 14	3,904
Griffin clay	Ind. 8	1,600

[1] For key to numbers in this column, see p. 253.

Sharkey clay.—The soil is a stiff, waxy, yellow clay, 6 inches deep, containing lime and iron concretions. The subsoil is a stiff, impervious clay similar to the soil. The surface sun-cracks readily. The type is locally known as "buckshot land." It is a poorly drained soil, occupying the lowest portions of river bottoms, and is subject to overflow annually. When diked and well drained it is a strong soil, suited to sugar cane and rice, and less well adapted to corn and cotton.

Trinity clay.—The soil, to a depth of from 8 to 15 inches, is a dark-gray to black stiff clay loam or clay. The subsoil is a heavy, stiff clay, usually of a lighter color than the soil—generally drab to gray—though the dark color may sometimes extend to a depth of 3 feet or more. The soil is quite plastic when wet and bakes hard, and cracks on drying. Intractable clods are formed when plowed too wet or too dry. The type occupies comparatively level bottoms along the streams in and issuing from the calcareous prairies of

the Gulf Coastal Plain, and is composed mainly of material washed from them. It is a very productive soil, being, where well drained and protected from overflow, admirably adapted to corn, cotton, Johnson grass, and alfalfa.

Wabash clay.—The soil is a drab to black heavy clay loam, 6 inches deep, containing considerable organic matter. The soil sun-cracks badly, frequently forming small aggregates which cause a close resemblance to "buckshot land." The subsoil is a drab or gray clay, sometimes resting upon fine sand at a depth of about 5 feet. The type occupies low areas to the rear of front lands and higher ridges in open forest lands in river deltas. It would usually be improved by drainage. In the northern areas the soil is adapted to corn, giving large yields under thorough cultivation. In the southern areas it is the finest cotton soil, yielding about 1¼ bales per acre. It is the best cotton soil of the Mississippi Delta; but the crop is late, and it is upon such soil that the boll weevil will be hardest to combat.

Miller clay.—The type consists of 10 inches of brownish-red or chocolate-colored clay, underlain by a stiff, tenacious brown or red clay subsoil. In some cases a yellow fine sandy loam is found at a depth of 3 feet, while in depressed areas subject to frequent and long-continued overflows a drab or blue clay may form the deeper subsoil. This soil represents the finest materials brought down by streams from the Permian Red Beds and deposited during overflows. It is a strong soil for corn, cotton, and sugar cane, and where well drained large yields are secured.

Ocklocknee clay.—This soil consists of from 8 to 15 inches of loam or variable texture, resting on a stiff, tenacious clay of dark-yellow, mottled-red or black color. The subsoil contains a noticeable quantity of finely divided quartz rock. The type lies along the river, is subject to overflow, and very little of it is under cultivation. With protection from overflow and good drainage the soil would be very productive for cotton, corn, and hay.

Waverly clay.—The soil consists of a light-brown clay loam about 10 inches deep. The percentage of clay and silt is high, and the soil rapidly becomes stiffer and more tenacious with depth, grading into a heavy, tenacious clay subsoil of a brown or drab color, often mottled in the depressions. A few small iron concretions are frequently seen both in the soil and the subsoil, especially in the more swampy areas. The type occupies low bottom lands and is subject to overflow. This soil is best adapted to corn, and when well drained and cultivated it yields as much as 60 bushels per acre. Wheat, when not damaged or destroyed by floods, does well, and also oats and tobacco. Clover, timothy, and other grasses give large yields.

Cahaba clay.—The soil consists of a stiff reddish-brown to red clay, sometimes slightly streaked and mottled with yellow. It is frequently overlain by from 1 to 4 inches of a brownish material of lighter texture. The presence of mica flakes frequently imparts a greasy feel to the subsoil. The material of soil and subsoil consists principally of material brought down from the Piedmont. The shallow surface veneering is derived in part from the soils of the adjacent uplands. The type occupies the older higher terraces along the larger streams in the Coastal Plain of the Gulf States and is subject to overflow not oftener than once in ten or fifteen years. It is very productive, making excellent yields of oats and cotton with but little fertilization. Crops sometimes suffer during drought when the soil has not been thoroughly broken and kept well mulched. It requies a heavy farm equipment to maintain its highest efficiency.

Congaree clay.—The type consists of 3 feet or more of light-brown or chocolate-colored clay, containing a large percentage of silt. The material from 8 to 36 inches is a little lighter in color and a little heavier in texture than the top soil, and occasionally a thin seam of very fine sand is found. The terraces contain a little more sand than the low-lying areas, and often small particles of mica, brought down from the Piedmont, are scattered through the soil. This soil type commonly occurs in strips or terraces near rivers or streams, and frequent overflows make it an uncertain soil for crops. It is adapted to Bermuda grass, and good yields of corn and oats are secured in favorable seasons. With better drainage large yields may be secured.

Cameron clay.—The soil is a heavy, dark-brown to black clay, with an average depth of 12 to 15 inches. The subsoil, from 12 to 36 inches, is a heavy clay lighter colored than the soil. The soil puddles and bakes badly. Small lime concretions frequently occur in the deeper subsoil. Areas of this soil form bottom-land depressions bordering abandoned stream courses and has very poor drainage. Alkali accumulations have stopped former rice culture, but where well drained good yields of general farm crops are secured.

Sanders clay.—This type is composed of 6 to 8 inches of grayish silty clay, underlain to a depth of 3 feet or more by ashy-gray, sticky, impervious clay, which becomes almost white on exposure. The soil is typically developed along the larger streams. The surface is level and subject to such frequent overflow that no crops are grown. Under the present conditions this is not a desirable soil for agricultural purposes, but if artificially drained and protected from floods it would be well adapted to grass and some of the staple crops of the region.

Huntington clay.—The soil is a dark-brown to nearly black silty clay loam to silty clay. The subsoil is a light-brown to dark-brown silty clay. The type occupies first bottoms subject to overflow. The

material is derived principally from sandstone, shale, and limestone soils of the Appalachian Mountains and limestone valleys. When drained corn and grass do well. Late truck crops, as cabbage and tomatoes, are sometimes grown.

Osage clay.—The Osage clay consists of 18 inches of black, heavy, silty clay or clay which is underlain by a bluish-drab clay subsoil. Frequently little change is observed between the soil and the subsoil. The type represents the heaviest material washed from the prairie uplands of sandstone and shale soils. Practically all of the type is subjected to deep and prolonged overflow, but when drained and protected from floods large yields of corn and other crops may be secured.

Calhoun clay.—The soil consists of a gray, heavy clay 2 to 6 inches deep. The subsoil is a very heavy, tenacious, waxy clay of a gray or drab color. Numerous small iron concretions are found throughout the soil and subsoil. Sometimes the soil to a depth of 12 inches is a gray, silty clay. It is very nearly level and is very poorly drained. Water stands on it for a long time during wet seasons, though it is never overflowed. If well drained it makes a good soil for cotton.

Bastrop clay.—The soil is a dark-gray clay loam to heavy clay, 6 to 10 inches deep, underlain to 36 inches by a dark-gray to dark-brownish gray compact and plastic clay subsoil. Both soil and subsoil contain large quantities of silt and much organic matter. The soil bakes badly and requires careful cultivation with heavy teams to secure proper tilth. This soil occurs irregularly along the bottoms of some of the rivers in Texas, and has comparatively level topography with occasional swells or gentle depressions. Drainage is not exceptionally good, and much of the area is greatly benefited by surface ditching, though but little damage is ever done by overflow. It is probably the strongest soil of these bottoms, and is well adapted to general farming. Cotton, corn, and sorghum are the principal products, corn doing better than cotton. Alfalfa may be successfully grown. It would be much improved and the crops made more secure by drainage.

Elk clay.—The soil is a grayish to light-brown silty clay. The subsoil is a mottled gray and yellow somewhat plastic clay or silty clay. The soil is alluvial in origin, having been derived from the limestone, sandstone, and shale soils of the Appalachian Mountains and limestone valleys. It occupies second terraces lying in part completely above overflow and in part above normal overflow. It is well adapted to corn, grain, and grass.

Bibb clay.—The soil consists of a mottled gray to nearly white compact silty clay from about 4 to 8 inches deep. The subsoil is a light-gray to nearly white compact plastic silty clay, more or less

mottled with yellowish or brownish colors. Owing to its intractible structure the soil clods badly and bakes in dry weather. It is a poorly drained, first-bottom alluvial soil derived from Coastal Plain material. In good seasons both cotton and corn do well, but the average yields are rather low on account of poor underdrainage and overflows. Grass does very well. With the establishment of better drainage and liberal applications of lime this could be made quite a productive soil.

Laredo clay.—The soil consists of a light-brown to drab clay loam, about 10 inches deep. The upper 2 or 3 inches of the soil often contain enough fine sand to give a slightly gray appearance, but the soil becomes stiff and heavy at a very slight depth, and at 6 to 10 inches it contains little or no fine sand. The subsoil to a depth of 3 feet or more is a light-brown to drab, stiff heavy clay. In the lower part of the soil profile it is so dry and compact that it is difficult to penetrate with a soil augur. The type is comparatively level in topography. It is formed from materials held in suspension by the waters of Chacon Creek, and laid down during times of overflow. Particles of silt and clay which have been washed down from the neighboring hills and ridges also enter into the formation of the soil. None of the type is under cultivation, the areas supporting a dense growth of mesquite and other native vegetation.

Griffin clay.—This is a very compact soil, composed of medium to fine gravel, coarse sand rounded by water action, and clay. The clay is dark brown or mottled in color, very stiff and waxy, and difficult to work. There is an average gravel content of about 10 per cent. The type occupies the broad, level floor of the Black River Valley, Texas. A large proportion of the type is covered by forest. Corn is the chief product, but considerable areas are devoted to wheat and oats.

SILTY CLAY PHASE.

A relatively small area in the River Flood Plain province is occupied by the silty clays of the clay group of soils. The table below shows the extent and distribution of five different types in this phase.

TABLE CIX.—*Area and distribution of the silty clay.*

Name of soil.	State and area.[1]	Acres.
Huntington silty clay	Tenn. 1; W. Va. 3	47,936
Wabash silty clay	Kans. 5; Mo. 1; Okla. 1	11,456
Rio Grande silty clay	Tex. 5	8,064
Sarpy silty clay	Mo. 4	1,792
Laredo silty clay	Tex. 5	448

[1] For key to numbers in this column, see p. 253.

Huntington silty clay.—The type consists of compact brown silty loam to silty clay loam about 12 inches deep, overlying a compact silty clay of a somewhat lighter brown color. It occurs principally as first bottoms along the Ohio and Little Kanawha rivers, and, though from 10 to 15 feet above the normal level of these streams, it is liable to inundation during the spring months. Along some of the smaller streams some variations in texture are usual, with a tendency toward larger percentages of sand. The topography is level to slightly rolling, and the surface drainage and subdrainage are fairly good. Though the soil exhibits a decided tendency to clod and is heavy to work, intelligent management produces good tilth, and it is a valuable type for corn and hay, with average yields of 50 bushels of the former and 1½ tons of the latter per acre.

Wabash silty clay.—The soil varies in depth from 12 to 24 inches and consists of a dark-brown medium to heavy silt clay. The subsoil to a depth of 36 inches consists of a compact and rather heavy brownish or yellowish silt clay. The type occupies a rather low position in stream valleys and on gentle slopes. In the former position its surface is very nearly level or gently sloping. It occurs as first bottom, lying from 4 to 20 feet above the smaller streams, and in the river valleys as second bottom, from 20 to 40 feet above the river bed. It is seldom overflowed and then only in small areas and for brief periods. It is especially adapted to the production of corn and alfalfa, care being taken to have the alfalfa on gentle slopes where drainage is good. Besides these crops some wheat and oats are grown. Both small and tree fruits and late vegetables do well.

Rio Grande silty clay.—The soil consists of 12 inches of dark-brown to black silty clay. The subsoil becomes lighter in texture with depth. The surface bakes badly. Low ridges of fine sand and silt may occur through the type. It occupies the lower terraces in the larger bends of the Rio Grande River and is subject to occasional overflow. Most of the type supports a heavy growth of palms, tules, cane, and marsh grasses. Cotton and corn produce fair yields on the best drained areas.

Sarpy silty clay.—This type is a dark-brown to almost black silty clay, about 14 inches deep, underlain by a lighter colored fine sandy loam. Thin layers of clay are sometimes encountered in the subsoil. The soil cracks and breaks into cubes upon drying. It is difficult to handle, but when properly cultivated is a productive soil.

Laredo silty clay.—The soil is a heavy brown silty clay about 15 inches deep. This grades into a lighter colored stiff, compact, silty clay subsoil. At 25 to 30 inches the subsoil grades into a light-brown silty loam. The soil does not form a hard crust on drying. The surface is nearly level, with a gentle slope toward the adjacent

lowlands, giving moderately good drainage. Alkali occurs in small depressions. Under irrigation it produces good yields of corn, cotton, sugar cane, and late vegetables.

MISCELLANEOUS MATERIALS.

In the River Flood Plains province, owing chiefly to conditions of deficient drainage, very considerable areas of the surface have been mapped without regard to textural differences. These areas have been grouped for the present under six heads of miscellaneous material. Much of the area of these soils when reclaimed will become valuable agricultural lands, and at some future day may be classified with the other series of the River Flood Plains province.

TABLE CX.—*Area and distribution of miscellaneous materials.*

Kind of material.	State and area.[1]	Acres.
Meadow	Ala. 1, 2, 3, 4, 5, 8, 11, 12, 16, 20, 21, 23, 24, 25, 26, 28; Ark. 2; Del. 1; Fla. 1, 2, 4, 5; Ga. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13; Ill. 3, 11; Ind. 1, 4, 6; Ia. 1, 2, 3; Ky. 3; La. 2 3, 4, 6, 8, 10, 11, 12; Md. 1, 2, 4, 5, 6, 7, 8, 9; Mich. 1, 2, 3, 5, 6, 7, 8; Minn. 1, 2, 4, 5; Miss. 1, 3, 4, 5, 7, 9, 14, 15; Mo. 1, 9, 11; Neb. 1; N. H. 1, 2; N. J. 1, 2; N. Y. 1, 2, 4, 6, 7, 10, 12, 13, 15; N. C. 1, 2, 3, 4, 9, 11, 12, 14, 18, 21; N. D. 2, 5, 8, 9; Ohio 1, 3, 7; Okla. 2; Pa. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; R. I. 1; S. C. 1, 2, 3, 5, 8, 12, 14; S. D. 1; Tenn. 5, 10; Tex. 1, 3, 6, 9, 10, 11, 12, 13, 15, 17, 18, 19, 21, 24, 27, 28, 29; Vt. 1; Va. 1, 2, 3, 4, 5, 6, 7, 8, 9, 11; W. Va. 1, 5; Wis. 2, 4, 6.	2,967,503
Swamp	Ala. 1, 2, 11, 15; Ark. 3; Conn. 1; Del. 1; Fla. 4, 5, 6; Ga. 9, 11, 12, 13; La. 1, 3, 4; Md. 2, 9, 10; Mass. 1; Miss. 3, 13; N. Y. 5; N. C. 5, 6, 7, 8, 15, 16, 17, 18, 19, 20; Pa. 3; S. C. 6, 7, 9, 11, 13; Tex. 3; Va. 5, 6, 10, 12.	1,222,760
Muck	Ala. 2; Ky. 2; La. 9; Neb. 4	45,312
Riverwash	Ind. 3, 10; Ky. 2; La. 5; Mo. 1, 12; N. D. 5	30,080
Marsh	Fla. 1, 4; La. 11	9,024
Overwash	Mo. 1	7,232

[1] For key to numbers in this column, see p. 253.

Meadow.—This term is used to designate low-lying, flat, usually poorly drained land, such as may occur in any soil type. These areas are frequently used for grass, pasturage, or forestry, and can be changed to arable land if cleared and drained. The present character of Meadow is due to lack of drainage, and the term represents a condition rather than a classification according to texture. Textural variations frequently occur in Meadow areas on a scale too small to permit of mapping. In many areas the term "Meadow" has also been used to represent small bodies of bottom land, occasionally or frequently subject to overflow, which are normally placed under cultivation and constitute land of high value for the production

of various general farm crops. Within these bottoms the soils vary frequently in texture, even within small areas, and on account of occasional overflow the character of the soil at any one point is subject to change.

Swamp.—This term is used to designate areas too wet for any crop and covered with standing water for much or all of the time. Variations in texture and in organic matter content may occur. Swamp frequently occupies areas which are inaccessible, so that detailed mapping is impracticable. The native vegetable growth consists of water-loving grasses, shrubs, and trees. Many areas of swamp may be drained, and when this is properly accomplished they not infrequently constitute lands of high agricultural value.

Muck.—This type consists of black, more or less thoroughly decomposed vegetable mold, from 1 foot to 3 feet or more in depth, and occupying low, wet places, with little or no natural drainage. Muck may be considered an advanced stage of Peat, brought about by the more complete decomposition of the vegetable fiber and the addition of mineral matter through deposition by water or by the wind, resulting in a fine texture and close structure. When drained, Muck is very productive and is adapted to corn, potatoes, cabbage, onions, celery, peppermint, and other special crops.

Riverwash.—This consists of sand, gravel, and bowlders, generally in long, narrow bodies, but occasionally spread out in fan-shaped areas. These areas occupy river bottoms or flood channels, and occur where the streams are intermittent or liable to torrential overflow. They are of no agricultural value.

Marsh.—This term is used to designate low, wet, treeless areas usually covered by standing water and supporting a growth of coarse grasses and rushes. These marsh areas occur around the borders of fresh-water lakes and the lower courses of streams. They can seldom be drained without diking and pumping. When this is done the soil is usually productive.

Overwash.—Overwash consists of soil material brought in by lateral streams or resulting from breaks in dykes and levees and spread as a blanket over relatively broad bottoms. It ranges from a thin covering of a few inches to a thickness of 3 feet or more, and if drained and protected from further accumulations and washing is a soil of high agricultural value.

SUMMARY.

Of the total area, 12,756,177 acres, surveyed in the River Flood Plains province there are only 491,803 acres, or 3.9 per cent, of the area of sand, fine sand, and sandy loam soils, or soils adapted to early truck crops.

There are 1,036,672 acres, or 8.2 per cent, of fine sandy loam adapted to truck crops for the medium early markets and to light general farming.

There are 1,509,811 acres, or 11.8 per cent, of loam soils adapted to canning crops and fruit and medium heavy general farming.

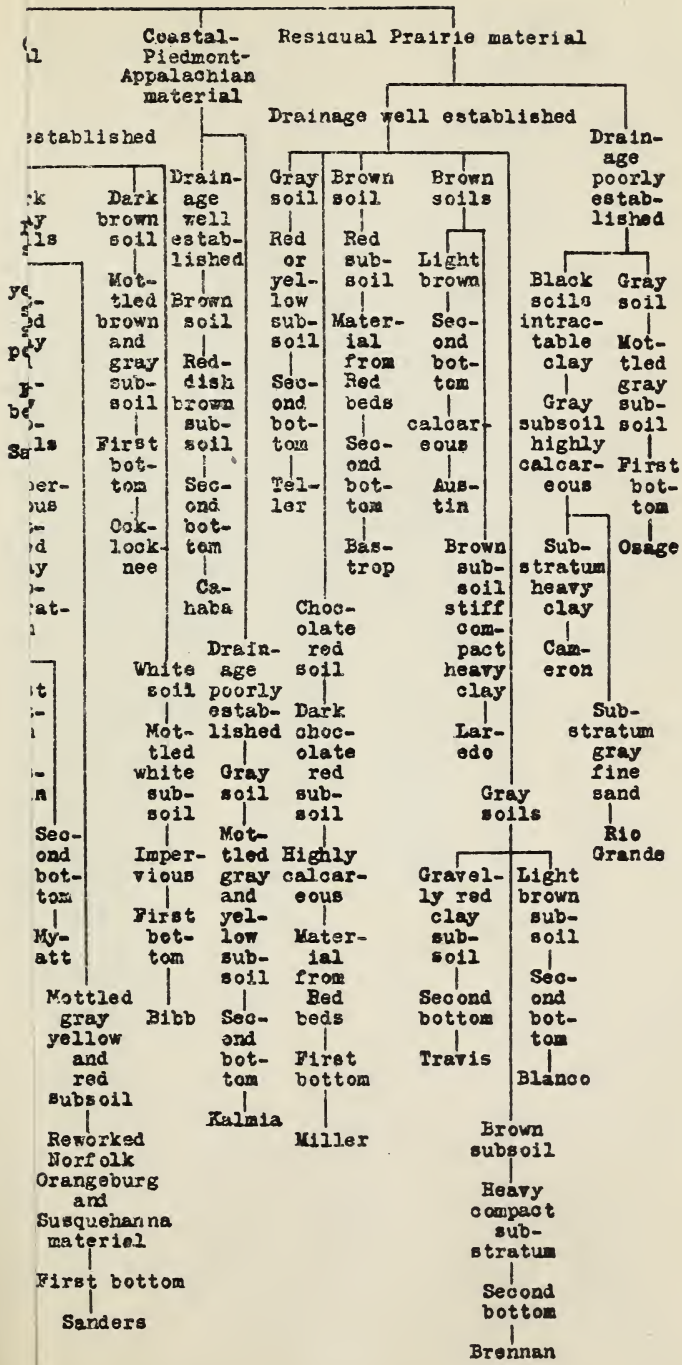
There are 2,262,053 acres, or 17.4 per cent, of silt loams adapted to heavy general farming.

There are 282,752 acres, or 2.2 per cent, of clay loams and 2,891,175 acres, or 22.7 per cent, of clay soils adapted to very heavy general farming.

There are 4,281,911 acres, or 33.5 per cent, of miscellaneous materials which will require extensive and expensive reclamation work to adapt them properly to any crop.

The classification of the soils of this province is shown in the diagram, figure 16, facing page 252.

Fig. 16.


Coastal-Piedmont-Appalachian material
Residual Prairie material
Drainage well established
Drainage well established
Drainage poorly established
Dark brown soil
Mottled brown and gray subsoil
First bottom
Cooklocknee
Drainage well established
Brown soil
Reddish brown subsoil
Second bottom
Cahaba
Gray soil
Red or yellow subsoil
Second bottom
Teller
Brown soil
Red subsoil
Material from Red beds
Second bottom
Bastrop
Brown soils
Light brown
Second bottom
calcareous
Austin
Brown subsoil stiff compact heavy clay
Laredo
Black soils intractable clay
Gray subsoil highly calcareous
Substratum heavy clay
Cameron
Gray soil
Mottled gray subsoil
First bottom
Osage
Substratum gray fine sand
Rio Grande
Chocolate red soil
Dark chocolate red subsoil
Highly calcareous
Material from Red beds
First bottom
Miller
White soil
Mottled white subsoil
Impervious
First bottom
Bibb
Drainage poorly established
Gray soil
Mottled gray and yellow subsoil
Second bottom
Kalmia
Gray soils
Gravelly red clay subsoil
Second bottom
Travis
Light brown subsoil
Second bottom
Blanco
Brown subsoil
Heavy compact substratum
Second bottom
Brennan
Second bottom
Myatt
Mottled gray yellow and red subsoil
Reworked Norfolk Orangeburg and Susquehanna material
First bottom
Sanders

Key to the Soils of the River Flood Plains Province

CHANGES IN CLASSIFICATION INVOLVING CHANGE IN SOIL NAMES.

It has been found necessary, with the constantly increasing knowledge of soils gained in the rapid extension of the soil surveys, to make certain readjustments in the classification of various types. In a number of cases the original soil names are really little more than provisional names of value only until such time as further study and investigation enable the office to determine the true relationships of the given soils to others, perhaps already mapped or more often encountered subsequently in some new area. There have been made, also, notwithstanding the utmost care in the work of correlation, some errors of judgment as to the proper placing of soils in series, and these errors, when discovered, have been rectified, even though a change of name has been necessary.

These changes are shown in the appended list, both the original name and the new name being stated. The name of the area in which the soil was encountered is given in the first column, as for instance, "Autauga Co. 1908." The date is that of the annual report of the Bureau—Field Operations of the Bureau of Soils—in which the report of the survey is published. At the left of this column will be noticed a column of numbers, which are for use in connection with the tables given throughout the body of this bulletin. They enable the reader who may desire a fuller description of any soil than afforded in this work to turn at once to the report where such description is given. He should, however, be careful to note if the soil is one that has been recorrelated, as in that case the type will be described under the original name and not under the name used in the text and table in the present volume.

Areas surveyed and changes which have been made in the correlation of the soils since the reports were published.

Name of area.	Soil name as published.	Changed to—
Alabama.		
1. Autauga County, 1908.		
2. Baldwin County, 1909.		
3. Bibb County, 1908	Waverly silt loam	Bibb silt loam.
4. Blount County, 1905	Fort Payne stony loam	Clarksville stony loam.
	Upshur loam	Decatur loam.
5. Butler County, 1907.		
6. Calhoun County, 1908.		

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Alabama—Continued.		
7. Chambers County, 1909.		
8. Coffee County, 1909.		
9. Colbert County, 1908	Leighton loam	Clarksville loam.
	King clay	Colbert clay.
	King clay loam	Colbert clay loam.
10. Cullman County, 1908.		
11. Dallas County, 1905	Norfolk clay	Cahaba clay.
12. Etowah County, 1908.		
13. Fort Payne area, 1903	Clarksville loam	Huntington silt loam.
	Penn sandy loam	Upshur sandy loam.
	Fort Payne stony loam	Clarksville stony loam.
	Chattooga loam	Holston loam.
14. Hale County, 1909.		
15. Henry County, 1908.		
16. Huntsville area, 1903	Clarksville clay	Elk clay.
	Hagerstown silt loam	Clarksville silt loam.
17. Jefferson County, 1908	Wabash clay	Huntington clay.
18. Lamar County, 1908	Norfolk loam	Kalmia loam.
	Waverly loam	Bibb loam.
19. Lauderdale County, 1905	Clarksville loam	Huntington silt loam.
	Clarksville clay loam	Hagerstown loam.
20. Lee County, 1906.		
21. Macon County, 1904	Houston black clay	Houston clay.
	Lufkin clay	Susquehanna clay.
	Ocklocknee clay	Congaree clay.
22. Marion County, 1907	Norfolk silt loam	Kalmia silt loam.
23. Mobile area, 1903.		
24. Montgomery County, 1905	Norfolk clay	Cahaba clay.
	Yazoo clay	Trinity clay.
25. Perry County, 1902	Norfolk sand	Norfolk fine sand.
	Sassafras sandy loam	Cahaba sandy loam.
	Orangeburg sandy loam	Orangeburg fine sandy loam.
26. Sumter County, 1904	Lufkin clay loam	Lufkin clay.
	Warsaw sandy loam	Cahaba fine sandy loam.
	Waverly loam	Ocklocknee loam.
27. Talladega County, 1907.		
28. Tallapoosa County, 1909	Cecil slate loam	Louisa slate loam.
Arkansas.		
1. Conway County, 1907	Wabash fine sand	Huntington fine sand.
	Wabash fine sandy loam	Huntington fine sandy loam.
	Wabash silt loam	Huntington silt loam.
	Wabash clay	Huntington clay.
2. Fayetteville area, 1906	Wabash loam	Huntington loam.
	Wabash silt loam	Huntington silt loam.
	Wabash clay loam	Huntington clay loam.
3. Miller County, 1903	Sharkey clay	Miller clay.
4. Prairie County, 1906.		
5. Stuttgart area, 1902	Almyra silt loam	Crowley silt loam.
	Miami clay loam	Crowley silt loam.
Connecticut.		
1. Connecticut Valley, 1903	Connecticut meadows	Podunk silt loam.
	Connecticut swamp	Swamp.
	Triassic stony loam	Wethersfield loam.
	Chicopee gravel loam	Merrimac gravelly sandy loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Connecticut—Continued.		
1. Connecticut Valley, 1903	Norfolk coarse sandy loam.	Merrimac coarse sandy loam.
	Windsor sand	Merrimac coarse sand.
	Enfield sandy loam	Manchester fine sand.
	Elmwood loam	Suffield loam.
Delaware.		
1. Dover area, 1903	Galveston sand	Coastal beach.
	Elkton clay	Elkton silt loam.
	Galveston clay	Tidal marsh.
	Norfolk loam	Sassafras sandy loam.
	Norfolk silt loam	Sassafras silt loam.
Florida.		
1. Escambia County, 1906	Galveston sand	Coastal beach.
	Orangeburg loam	Greenville loam.
2. Gadsden County, 1903	Orangeburg sandy loam.	Orangeburg fine sandy loam.
3. Gainesville area, 1904.		
4. Jefferson County, 1907.		
5. Leon County, 1905.		
6. Marianna area, 1909.		
Georgia.		
1. Bainbridge area, 1904.		
2. Cobb County, 1901	Herndon stony loam	Porters stony loam.
3. Covington area, 1901.		
4. Dodge County, 1904	Norfolk sandy loam	Tifton sandy loam.
5. Fort Valley area, 1903	Norfolk sandy loam	Norfolk fine sandy loam.
	Orangeburg sandy loam.	Orangeburg fine sandy loam.
	Selma clay	Cahaba clay.
6. Franklin County, 1909.		
7. Grady County, 1908.		
8. Hancock County, 1909.		
9. Pike County, 1909.		
10. Spalding County, 1905	Cecil sand	Durham sandy loam.
11. Thomas County, 1908.		
12. Tift County, 1909.		
13. Waycross area, 1906.		
Illinois.		
1. Clay County, 1902	Yazoo sandy loam	Waverly fine sandy loam.
2. Clinton County, 1902	Edgerton silt loam	Miami silt loam.
	Kaskaskia loam	Wabash silt loam.
	Yazoo clay	Wabash clay.
	Miami silt loam	Marshall silt loam.
3. Dubuque area, Iowa, 1902	Miami fine sand	Lintonia fine sand.
	Miami silt loam	Knox silt loam.
	Lintonia loam	Wabash silt loam.
	Clarksville stony loam	Rough stony land.
4. Johnson County, 1903	Yazoo clay	Wabash clay.
5. Knox County, 1903	Kaskaskia loam	Wabash silt loam.
	Miami silt loam	Knox silt loam.
	Miami black clay loam	Marshall black clay loam.
6. McLean County, 1903	Kaskaskia loam	Wabash silt loam.
	Miami silt loam	Knox silt loam.
	McLean silt loam	Marshall loam.
	Miami black clay loam	Marshall black clay loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Illinois—Continued.		
7. O'Fallon area, Missouri, 1904.	Miami fine sand	Lintonia fine sand.
	Yazoo clay	Wabash clay.
	Miami silt loam	Knox silt loam.
8. Sangamon County, 1903	Kaskaskia loam	Wabash silt loam.
	Miami fine sand	Knox fine sand.
	Miami black clay loam	Marshall black clay loam.
	Miami silt loam	Knox silt loam.
9. St. Clair County, 1902	Miami fine sandy loam	Memphis silt loam.
	Kaskaskia loam	Wabash silt loam.
	Yazoo clay	Wabash clay.
	Miami silt loam	Marshall silt loam.
	Lintonia loam	Lintonia silt loam.
10. Tazewell County, 1902	Lintonia loam	Wabash loam.
	Miami fine sand	Knox fine sand.
	Yazoo clay	Wabash clay.
	Miami black clay loam	Marshall black clay loam.
	Mackinaw gravel	Judson gravel.
	Tazewell silt loam	Knox silt loam.
	Miami loam	Sioux loam.
	Delavan silt loam	Sioux silt loam.
11. Winnebago County, 1903	Winnebago sandy loam	Carrington sandy loam.
	Miami fine sand	Coloma fine sand.
	Miami silt loam	Knox silt loam.
	Miami gravel	Judson gravel.
Indiana.		
1. Allen County, 1908	Miami black clay loam.	Carrington black clay loam.
2. Boonville area, 1904	Miami silt loam	Knox silt loam.
	Miami fine sandy loam	Lintonia fine sandy loam.
3. Greene County, 1906	Huntington fine sandy loam.	Wabash loam.
	Huntington silt loam	Wabash silt loam.
	Bloomfield sandy loam	Knox sandy loam.
	Miami sand	Knox sand.
	Miami silt loam	Knox silt loam.
	Marco fine sandy loam	Lintonia fine sandy loam.
	Marco clay loam	Wabash clay loam.
4. Madison County, 1903	Miami black clay loam	Carrington black clay loam.
	Madison loam	Sioux clay loam.
5. Marion County, 1907	Miami black clay loam	Carrington black clay loam.
	Miami gravelly loam	Chenango gravelly loam.
	Miami loam	Sioux loam.
	Miami sandy loam	Sioux sandy loam.
	Huntington loam	Wabash loam.
6. Marshall County, 1904	Marshall sandy loam	Waukesha sandy loam.
	Marshall loam	Carrington loam.
	Miami gravelly sandy loam.	Coloma gravelly sandy loam.
	Miami sand	Coloma sand.
	Miami black clay loam	Carrington black clay loam.
	Marshall sand	Waukesha sand.
7. Newton County, 1905	Kaskaskia loam	Wabash silt loam.
	Miami black clay loam	Carrington black clay loam.
	Miami fine sand	Dunkirk fine sand.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Indiana—Continued.		
7. Newton County, 1905	Marshall loam	Carrington loam.
	Marshall fine sand	Waukesha sand.
	Marshall fine sandy loam.	Carrington fine sandy loam.
8. Posey County, 1902	Memphis silt loam	Lintonia silt loam.
	Miami sandy loam	Wabash fine sandy loam.
	Waverly silt loam	Wabash silt loam.
	Miami fine sandy loam	Waverly fine sandy loam
	Yazoo loam	Waverly loam.
	Guthrie clay	Waverly clay loam.
	Yazoo clay	Waverly clay.
	Miami sand	Knox sand.
	Miami silt loam	Knox silt loam.
9. Scott County, 1904.		
10. Tippecanoe County, 1905	Marshall loam	Carrington silt loam.
	Miami black clay loam	Marshall black clay loam.
	Miami loam	Miami silt loam.
	Miami fine sandy loam	Knox fine sandy loam.
	Miami fine sand	Knox fine sand.
	Miami gravelly sandy loam.	Coloma gravelly sandy loam.
	Miami silt loam	Knox silt loam.
Iowa.		
1. Cerro Gordo County, 1903	Miami black clay loam	Carrington black clay loam.
	Marshall clay loam	Carrington clay loam.
	Marshall loam	Carrington loam.
	Marshall sand	Waukesha sand.
2. Dubuque area, 1902	Lintonia loam	Wabash silt loam.
	Clarksville stony loam	Rough stony land.
	Miami sandy loam	Knox sandy loam.
	Miami silt loam	Knox silt loam.
3. Story County, 1903	Miami black clay loam	Wabash clay loam.
	Marshall clay loam	Carrington clay loam.
	Marshall loam	Carrington loam.
4. Tama County, 1904	Kaskaskia loam	Wabash silt loam.
	Miami fine sand	Knox fine sand.
	Miami silt loam	Knox silt loam.
	Marshall loam	Carrington loam.
Kansas.		
1. Allen County, 1904	Sharkey clay	Wabash clay.
	Yazoo clay	Wabash clay.
2. Brown County, 1905	Yazoo silt loam	Wabash silt loam.
	Marshall sandy loam	Carrington sandy loam.
	Marshall gravelly loam	Carrington gravelly loam.
3. Garden City area, 1904.		
4. Parsons area, 1903	Oswego silt loam	Neosho silt loam.
	Sharkey clay	Wabash clay.
	Yazoo clay	Crawford clay.
5. Riley County, 1906	Wabash silt clay	Wabash silty clay.
6. Russell area, 1903	Benton loam	Houston clay.
	Waldo loam	Wabash silt loam.
7. Wichita area, 1902	Miami sand	Laurel sand.
	Miami fine sand	Laurel fine sand.
	Clarksville stony loam	Rough stony land.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Kentucky.		
1. McCracken County, 1905.		
2. Madison County, 1905	Wabash silt loam	Huntington silt loam.
3. Mason County, 1903	Leonardtown loam	Huntington silt loam.
	Norfolk fine sandy loam.	Cumberland fine sandy loam.
	Elkton clay	Holly clay loam.
	Norfolk loam	Cumberland sandy loam.
4. Scott County, 1903.		
5. Union County, 1902	Miami silt loam	Knox silt loam.
	Sturgis fine sandy loam.	Lintonia fine sandy loam.
	Memphis silt loam	Lintonia silt loam.
	Waverly silt loam	Wabash silt loam.
	Miami fine sandy loam.	Waverly fine sandy loam
	Sharkey clay	Waverly clay.
	Yazoo clay	Waverly clay.
6. Warren County, 1904	Clarksville loam	Huntington silt loam.
Louisiana.		
1. Acadia Parish, 1903.		
2. Bienville Parish, 1908.		
3. Caddo Parish, 1906.		
4. De Soto Parish, 1904.		
5. East and West Carroll Parishes, 1908.	Yazoo coarse sand	Riverwash.
6. East Baton Rouge Parish, 1905.	Yazoo clay	Wabash clay.
7. Lake Charles area, 1901	Calcasieu fine sand	Caddo fine sand.
	Calcasieu fine sandy loam.	Caddo fine sandy loam.
	Calcasieu loam	Caddo loam.
8. Lincoln Parish, 1909.		
9. New Orleans area, 1903	Galveston clay	Tidal marsh.
	Yazoo clay	Wabash clay.
10. Ouachita area, 1903	Monroe fine sandy loam.	Miller fine sandy loam.
11. Tangipahoa Parish, 1905	Yazoo clay	Wabash clay.
12. Winn Parish, 1907.		
Maine.		
1. Caribou area, 1908.		
2. Orono area, 1909.		
Maryland.		
1. Anne Arundel County, 1909.		
2. Calvert County, 1900	Susquehanna gravel	Norfolk gravel.
	Windsor sand	Norfolk coarse sand.
	Norfolk loam	Sassafras loam.
	Sassafras loam	Sassafras silt loam.
	Sassafras sandy loam	Sassafras fine sandy loam.
3. Cecil County, 1900	Elkton clay	Elkton silt loam.
	Susquehanna gravel	Norfolk gravel.
	Sassafras loam	Sassafras silt loam.
	Cecil mica loam	Manor loam.
	Cecil loam	Chester loam.
	Norfolk sand	Sassafras sand.
4. Easton area, 1907.		

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Maryland—Continued.		
5. Harford County, 1901	Norfolk sand	Sassafras sand.
	Elkton clay	Elkton silt loam.
	Susquehanna gravel	Norfolk gravel.
	Sassafras loam	Sassafras silt loam.
	Cecil mica loam	Manor loam.
	Cecil loam	Chester loam.
6. Kent County, 1900	Elkton clay	Elkton silt loam.
	Susquehanna gravel	Norfolk gravel.
	Sassafras loam	Sassafras silt loam.
	Norfolk sand	Sassafras sand.
7. Leesburg area, Virginia, 1903.	Loudoun sandy loam	Chester sandy loam.
	Cecil mica loam	Manor loam.
	Hagerstown shale loam	Dekalb shale loam.
	Cecil loam	Chester loam.
8. Prince George County, 1901.	Elkton clay	Elkton silt loam.
	Leonardtown gravelly loam.	Leonardtown loam.
	Susquehanna gravel	Norfolk gravel.
	Windsor sand	Norfolk coarse sand.
	Westphalia sand	Sassafras fine sand.
	Norfolk loam	Sassafras fine sandy loam.
	Sassafras loam	Sassafras silt loam.
	Cecil mica loam	Manor loam.
9. St. Marys County, 1900	Susquehanna gravel	Norfolk gravel.
	Windsor sand	Norfolk coarse sand.
	Norfolk loam	Sassafras fine sandy loam.
	Sassafras loam	Sassafras silt loam.
	Norfolk sand	Sassafras sand.
10. Worcester County, 1903	Galveston sand	Coastal beach.
	Elkton clay	Elkton silt loam.
	Galveston clay	Tidal marsh.
Massachusetts.		
1. Connecticut Valley, 1903	Connecticut meadows	Podunk silt loam.
	Connecticut swamp	Swamp.
	Triassic stony loam	Wethersfield loam.
	Chicopee gravel loam	Merrimac gravelly sandy loam.
	Norfolk coarse sandy loam.	Merrimac coarse sandy loam.
	Windsor sand	Merrimac coarse sand.
	Enfield sandy loam	Manchester fine sand.
	Elmwood loam	Suffield loam.
Michigan.		
1. Allegan County, 1901	Allegan black clay	Clyde loam.
	Kalamazoo gravelly loam.	Clyde gravelly sand.
	Allegan clay	Miami clay loam.
	Plainwell stony loam	Coloma stony sand.
	Allegan gravelly loam	Coloma gravelly sand.
	Allegan sand	Coloma sand.
	Allegan fine sandy loam.	Coloma fine sand.
	Allegan sandy loam	Coloma sandy loam.
	Allegan stony loam	Miami loam.
2. Alma area, 1904	Miami gravelly sand	Coloma gravelly sandy loam.
	Miami sand	Coloma sand.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Michigan—Continued.		
3. Cass County, 1906	Miami fine sandy loam	Coloma fine sandy loam.
	Miami sandy loam	Coloma sandy loam.
	Miami stony loam	Miami loam.
	Miami sand	Coloma sand.
	Miami fine sand	Coloma fine sand.
	Miami gravelly sandy loam.	Coloma gravelly sandy loam.
	Marshall loam	Carrington loam.
4. Munising area, 1904	Miami sand	Coloma sand.
	Miami sandy loam	Coloma sandy loam.
	Fort Payne sandy loam.	Dover fine sandy loam.
5. Owosso area, 1904	Saginaw sandy loam	Clyde sandy loam.
	Miami sand	Coloma sand.
	Miami fine sand	Dunkirk fine sand.
	Miami gravelly sand	Dunkirk gravelly sand.
6. Oxford area, 1905	Miami gravelly sandy loam.	Coloma gravelly sandy loam.
	Miami sand	Coloma fine sand.
	Miami sandy loam	Coloma sandy loam.
	Miami gravelly sand	Coloma gravelly sand.
	Miami black clay loam	Carrington black clay loam.
7. Pontiac area, 1903	Miami loam	Wabash loam.
	Miami sandy loam	Coloma sandy loam.
	Miami black clay loam	Carrington black clay loam.
	Plainwell stony loam	Coloma stony sand.
	Allegan gravelly loam	Coloma gravelly sandy loam.
	Oakland sandy loam	Miami fine sandy loam.
	Miami gravelly loam	Chenango gravelly loam.
	Miami sand	Coloma sand.
	Marshall gravel	Coloma gravelly sand.
8. Saginaw area, 1904	Saginaw sandy loam	Clyde sandy loam.
	Miami sand	Coloma sand.
	Miami fine sand	Dunkirk fine sand.
	Miami gravelly sand	Dunkirk gravelly sand.
9. Toledo area, Ohio, 1902	Miami sandy loam	Dunkirk sandy loam.
	Miami black clay loam	Clyde clay.
10. Wexford County, 1908	Miami sand	Coloma sand.
Minnesota.		
1. Blue Earth County, 1906	Marshall silt loam	Carrington silt loam.
	Marshall clay loam	Carrington clay loam.
	Marshall loam	Carrington loam.
	Marshall fine sandy loam.	Carrington fine sandy loam.
	Mankato sand	Sioux sand.
2. Carlton area, 1905	Miami gravelly sandy loam.	Coloma gravelly sandy loam.
	Miami fine sand	Coloma fine sand.
	Miami sandy loam	Coloma sandy loam.
	Miami stony loam	Miami loam.
	Barnum stony loam	Superior stony loam.
	Barnum loam	Superior loam.
	Miami sand	Coloma sand.
3. Crookston area, 1906	Benoit loam	Fargo loam.
	McLeod sand	Dunkirk sand.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Minnesota—Continued.		
4. Marshall area, 1903	Miami loam	Wabash loam.
	Fairview sandy loam	Marshall sandy loam.
	Miami black clay loam	Fargo loam.
	Marshall loam	Carrington loam.
	Marshall gravelly loam	Carrington gravelly loam.
	Marshall gravel	Carrington gravel.
5. Rice County, 1909.		
6. Superior area, Wis., 1904.		
Mississippi.		
1. Biloxi area, 1904.		
2. Clay County, 1909.		
3. Crystal Springs area, 1905.		
4. Holmes County, 1908	Lintonia loam	Lintonia silt loam.
5. Jackson area, 1904.		
6. Jasper County, 1907	Orangeburg loam	Greenville loam.
7. McNeill area, 1903	Neuse clay	Congaree clay.
8. Monroe County, 1908.		
9. Montgomery County, 1906	Lintonia loam	Lintonia silt loam.
10. Oktibbeha County, 1907	Waverly loam	Bibb loam.
	Waverly clay	Bibb clay.
	Wabash clay	Trinity clay.
11. Pontotoc County, 1906.		
12. Prentiss County, 1907.		
13. Scranton area, 1909.		
14. Smedes area, 1902	Yazoo clay	Wabash clay.
	Lintonia loam	Lintonia silt loam.
15. Yazoo area, 1901	Yazoo clay	Wabash clay.
	Lintonia loam	Lintonia silt loam.
Missouri.		
1. Atchison County, 1909.		
2. Bates County, 1908.		
3. Cedar County, 1909.		
4. Cooper County, 1909.		
5. Crawford County, 1905.		
6. Howell County, 1902	Clarksville loam	Wabash silt loam.
7. O'Fallon area, 1904	Miami silt loam	Knox silt loam.
	Miami fine sand	Lintonia fine sand.
	Yazoo clay	Wabash clay.
8. Putnam County, 1906	Shelby silt loam	Putnam silt loam.
9. Saline County, 1904	Clarksville loam	Wabash silt loam.
	Miami silt loam	Knox silt loam.
	Yazoo clay	Wabash clay.
10. Scotland County, 1905	Shelby silt loam	Putnam silt loam.
11. Shelby County, 1903	Shelby clay	Shelby loam.
	Shelby silt loam	Putnam silt loam.
	Shelby sand	Mankato sand.
12. Webster County, 1904	Clarksville loam	Huntington silt loam.
Nebraska.		
1. Grand Island area, 1903	Miami sand	Knox sand.
2. Kearney area, 1904.		
3. Lancaster County, 1906	Marshall loam	Carrington loam.
4. North Platte area, 1907.		
5. Sarpy County, 1905	Miami silt loam	Knox silt loam.
6. Stanton area 1903	Arkansas fine sandy loam	Wabash fine sandy loam.
	Elkhorn silt loam	Wabash silt loam.
	Miami fine sand	Knox fine sand.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
New Hampshire.		
1. Nashua area, 1909.		
2. Merrimac County, 1906.		
New Jersey.		
1. Salem area, 1901	Norfolk sand	Sassafras sand.
	Sassafras loam	Sassafras silt loam.
	Quinton sandy loam	Norfolk sandy loam.
	Elkton clay	Elkton silt loam.
	Windsor sand	Norfolk coarse sand.
	Elsinboro fine sand	Sassafras fine sandy loam.
	Westphalia sand	Sassafras sand.
2. Trenton area, 1902	Susquehanna gravel	Norfolk gravel.
	Windsor sand	Norfolk coarse sand.
	Elsinboro fine sand	Sassafras fine sand.
	Westphalia sand	Norfolk fine sand.
	Quinton sandy loam	Norfolk sandy loam.
	Sassafras loam	Sassafras silt loam.
	Cecil loam	Cecil stony loam.
New York.		
1. Auburn area, 1904	Miami fine sand	Dunkirk fine sand.
	Miami loam	Genesee loam.
	Miami stony loam	Ontario loam.
2. Bigflats area, 1902	Elmira fine sandy loam	Genesee fine sandy loam.
	Hagerstown shale loam	Volusia silt loam.
	Miami gravelly loam	Dunkirk gravelly loam.
	Elmira shale loam	Dunkirk shale loam.
	Elmira silt loam	Dunkirk silt loam.
3. Binghamton area, 1905	Wabash loam	Genesee loam.
4. Dutchess County, 1907	Rhinebeck loam	Hudson silt loam.
	Huntington silt loam	Ondawa silt loam.
	Merrimac loam	Fishkill loam.
	Merrimac gravelly loam	Fishkill gravelly loam.
	Merrimac gravelly sandy loam	Fishkill gravelly sandy loam.
5. Livingston County, 1908	Warren shale loam	Volusia loam.
6. Long Island area, 1903	Miami stony loam	Flushing loam.
	Alton stony loam	Plymouth sandy loam.
	Plainwell stony loam	Plymouth stony sand.
	Galveston sand	Coastal beach.
	Hempstead gravelly loam	Sassafras loam.
	Hempstead loam	Sassafras loam.
	Norfolk gravel	Susquehanna gravel.
	Norfolk coarse sandy loam	Carver coarse sandy loam.
	Sassafras sandy loam	Sassafras loam.
	Norfolk coarse sand	Carver coarse sand.
	Galveston sandy loam	Tidal marsh.
	Galveston clay	Tidal marsh.
	Norfolk sand	Sassafras sand.
7. Lyons area, 1902	Alton stony loam	Dunkirk stony loam.
	Miami fine sand	Dunkirk fine sand.
	Miami loam	Genesee loam.
	Miami stony loam	Ontario loam.
	Miami fine sandy loam	Dunkirk fine sandy loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name or area.	Soil name as published.	Changed to—
New York—Continued.		
7. Lyons area, 1902	Elmira silt loam	Dunkirk silt loam.
	Alloway clay	Dunkirk clay.
8. Madison County, 1906	Miami stony loam	Cazenovia loam.
	Miami fine sand	Dunkirk fine sand.
	Miami fine sandy loam	Dunkirk fine sandy loam.
	Huntington loam	Genesee loam.
9. Montgomery County, 1908	Nellis loam	Hagerstown loam.
10. Niagara County, 1906	Huntington loam	Genesee loam.
11. Syracuse area, 1903	Alloway clay	Dunkirk clay.
	Miami fine sand	Dunkirk fine sand.
	Miami silt loam	Dunkirk silt loam.
	Miami loam	Genesee loam.
	Penn clay	Upshur clay.
	Miami stony loam	Cazenovia loam.
	Miami gravelly loam	Dunkirk gravelly loam.
	Miami fine sandy loam	Dunkirk fine sandy loam.
	Alton stony loam	Dunkirk stony loam.
12. Tompkins County, 1905	Wabash loam	Genesee loam.
	Miami stony loam	Ontario loam.
13. Vergennes area, Vermont, 1904.	Alton stony loam	Adirondack stony sandy loam.
14. Washington County, 1909.		
15. Westfield area, 1901	Dunkirk shale loam	Dekalb clay.
	Volusia sandy loam	Volusia loam.
	Dunkirk gravelly loam	Dunkirk gravelly sandy loam.
	Dunkirk sandy loam	Dunkirk fine sandy loam.
	Cassadaga sand	Meadow.
North Carolina.		
1. Alamance County, 1901	Alamance silt loam	York silt loam.
	Herndon stony loam	Porters stony loam.
2. Asheville area, 1903.		
3. Cary area, 1901.		
4. Caswell County, 1908	Caswell sandy loam	Rough broken land.
5. Chowan County, 1906	Norfolk silt loam	Norfolk loam.
6. Craven area, 1903	Portsmouth clay	Portsmouth loam.
	Selma clay	Cahaba clay.
	Neuse clay	Congaree clay.
	Norfolk sand	Norfolk fine sand.
7. Duplin County, 1905.		
8. Edgecombe County, 1907.		
9. Gaston County, 1909.		
10. Greenville area, Tenn., 1904.		
11. Henderson County, 1907.		
12. Hickory area, 1902.		
13. Lake Mattamuskeet area, 1909.	Hyde mucky loam	Muck (Hyde mucky loam).
14. Mount Mitchell area, 1902.		
15. New Hanover County, 1906	Galveston sand	Coastal beach.
	Galveston fine sand	Coastal beach.
	Galveston clay	Tidal marsh.
16. Pasquotank and Perquimans counties, 1905.		
17. Pitt County, 1909.		

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
North Carolina—Continued.		
18. Raleigh to Newbern, 1900...	Neuse clay.....	Congaree clay.
	Norfolk sandy soil.....	Norfolk sandy loam.
	Selma silt loam.....	Norfolk sandy loam.
	Garner stony loam.....	Susquehanna gravelly loam.
	Goldsboro compact sandy loam.	Portsmouth sandy loam.
	Pocoson.....	Swamp.
	Savanna.....	Swamp.
	Selma heavy silt loam...	Portsmouth fine sandy loam.
19. Robeson County, 1908.		
20. Scotland County, 1909.		
21. Statesville area, 1901.....	Davie clay loam.....	Louisa loam.
	Herndon stony loam....	Porters stony loam.
22. Transylvania County, 1906.		
North Dakota.		
1. Cando area, 1904.....	Marshall loam.....	Carrington loam.
	Marshall gravel.....	Carrington gravel.
2. Carrington area, 1905.....	Marshall loam.....	Carrington loam.
	Hobart clay.....	Rough broken land.
	Carrington clay loam....	Wabash clay loam.
	Marshall silt loam.....	Carrington silt loam.
	Marshall stony loam.....	Carrington stony loam.
	Marshall gravelly loam..	Carrington gravelly loam
3. Fargo area, 1903.....	Miami loam.....	Fargo fine sandy loam.
	Wheatland sandy loam..	Carrington sandy loam.
	Miami black clay loam..	Fargo clay loam.
	Wheatland sand.....	Fargo sand.
	Marshall clay.....	Fargo clay.
	Marshall loam.....	Fargo loam.
	Marshall gravelly loam..	Fargo gravelly loam.
4. Grand Forks area, 1902.....	Miami loam.....	Fargo loam.
	Miami black clay loam..	Fargo silt loam.
	Miami sandy loam.....	Fargo fine sandy loam.
5. Jamestown area, 1903.....	Miami black clay loam..	Carrington black clay loam.
	Hobart clay.....	Rough broken land.
	Marshall silt loam.....	Carrington silt loam.
	Marshall loam.....	Carrington loam.
	Marshall stony loam.....	Carrington stony loam.
6. McKenzie area, 1907.		
7. Morton area, 1907.		
8. Ransom County, 1906.....	Marshall clay loam.....	Carrington clay loam.
	Marshall fine sandy loam	Carrington fine sandy loam.
	Marshall stony loam.....	Carrington stony loam.
	Marshall gravelly loam..	Carrington gravelly loam.
	McLeod sand.....	Dunkirk sand.
9. Richland County, 1908.....	Marshall loam.....	Carrington loam.
	Marshall gravelly sandy loam.	Carrington gravelly sandy loam.
10. Williston area, 1906.		

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Ohio.		
1. Ashtabula area, 1903	Dunkirk gravelly loam	Dunkirk gravelly sandy loam.
	Dunkirk sandy loam	Dunkirk fine sandy loam.
2. Auglaize County, 1909	Miami black clay loam	Carrington black clay loam.
3. Cleveland area, 1905	Miami stony loam	Miami loam.
4. Columbus area, 1902	Miami loam	Wabash loam.
	Miami black clay loam	Carrington black clay loam.
	Miami gravelly loam	Chenango gravelly loam.
5. Coshocton County, 1904	Miami loam	Wabash loam.
	Miami gravelly loam	Chenango gravelly loam.
6. Meigs County, 1906.		
7. Montgomery County, 1900	Miami sandy loam	Wabash sandy loam.
	Miami loam	Wabash loam.
	Miami black clay loam	Carrington black clay loam.
	Miami gravelly loam	Chenango gravelly loam.
8. Toledo area, 1902	Miami loam	Wabash loam.
	Miami black clay loam	Clyde clay.
	Miami clay loam	Dunkirk clay loam.
	Miami sand	Dunkirk sand.
	Miami sandy loam	Dunkirk sandy loam.
9. Westerville area, 1905	Miami loam	Wabash loam.
	Miami black clay loam	Carrington black clay loam.
	Miami gravelly loam	Chenango gravelly loam.
10. Wooster area, 1904	Yazoo clay	Wabash clay.
	Miami stony loam	Miami loam.
	Miami gravelly loam	Chenango gravelly loam.
	Miami sand	Coloma sand.
	Miami sandy loam	Dunkirk sandy loam.
Oklahoma.		
1. Oklahoma County, 1906	Wabash silt clay	Wabash silty clay.
2. Tishomingo area, 1906.		
Pennsylvania.		
1. Adams County, 1904	Cecil clay loam	Montalto clay loam.
	Cecil loam	Chester loam.
2. Berks County, 1909.		
3. Center County, 1908.		
4. Chester County, 1905	Brandywine loam	Manor loam.
	Norfolk silt loam	Sassafras silt loam.
	Portsmouth silt loam	Elkton silt loam.
5. Johnstown area, 1907.		
6. Lancaster area, 1900	Donegal gravelly loam	Norfolk gravelly loam.
	Hempfield stony loam	Cecil stony loam.
	Cecil mica loam	Manor loam.
	Edgemont stony loam	Dekalb stony loam.
	Hagerstown shale loam	Dekalb shale loam.
7. Lebanon area, 1901	Donegal gravelly loam	Norfolk gravelly loam.
	Cecil clay	Cecil stony loam.
	Edgemont stony loam	Dekalb stony loam.
	Hagerstown shale loam	Dekalb shale loam.
	Dauphin sandy loam	Dekalb sandy loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Pennsylvania—Continued.		
8. Lockhaven area, 1903	Norfolk silt loam	Huntington loam.
	Norfolk loam	Huntington fine sandy loam.
	Hagerstown shale loam	Dekalb shale loam.
9. Montgomery County, 1905	Cecil clay loam	Montalto clay loam.
	Chester mica loam	Manor loam.
	Cecil stony loam	Montalto stony loam.
10. Trenton area, N. J., 1902	Elsinboro fine sand	Sassafras fine sand.
	Sassafras loam	Sassafras silt loam.
Rhode Island.		
1. Entire State, 1904	Miami silt loam	Carver silt loam.
	Gloucester stony loam	Rough stony land.
	Alton stony loam	Plymouth sandy loam.
	Miami stony loam	Flushing loam.
	Galveston fine sand	Coastal beach.
	Norfolk coarse sand	Carver coarse sand.
	Warwick sandy loam	Carver coarse sandy loam.
	Galveston sandy loam	Tidal marsh.
South Carolina.		
1. Abbeville area, 1902	Davie clay loam	Louisa fine sandy loam.
2. Anderson County, 1909.		
3. Campobello area, 1903	Cecil sand	Durham sandy loam.
4. Charleston area, 1904	Galveston fine sand	Coastal beach.
	Galveston clay	Tidal marsh.
5. Cherokee County, 1905	Cecil silt loam	Louisa silt loam.
	Cecil sand	Durham sandy loam.
	Cecil fine sandy loam	Louisa fine sandy loam.
6. Conway area, 1909.		
7. Darlington area, 1902	Norfolk sandy soil	Norfolk sandy loam.
	Ayden fine sandy loam	Norfolk fine sandy loam.
	Sassafras loam	Cahaba fine sandy loam.
	Orangeburg sandy loam	Orangeburg sand.
	Orangeburg loam	Orangeburg sandy loam.
	Goldsboro compact sandy loam	Portsmouth sandy loam.
	Selma heavy silt loam	Portsmouth sandy loam.
8. Lancaster County, 1904	Cecil fine sandy loam	York fine sandy loam.
	Cecil silt loam	York silt loam.
9. Lee County, 1907.		
10. Oconee County, 1907	Pilot loam	Talladega loam.
11. Orangeburg area, 1904.		
12. Saluda County, 1909	Durham fine sandy loam.	York fine sandy loam.
13. Sumter County, 1907.		
14. York County, 1905	Cecil sand	Durham sandy loam.
	Cecil fine sandy loam	York fine sandy loam.
	Cecil silt loam	York silt loam.
South Dakota.		
1. Belle Fourche area, 1907.		
2. Brookings area, 1903	Miami black clay loam	Fargo clay loam.
	Marshall loam	Carrington silt loam.
	Marshall sandy loam	Carrington sandy loam.
	Marshall stony loam	Carrington stony loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Tennessee.		
1. Coffee County, 1908	Hillsboro silt loam	Clarksville silt loam.
2. Davidson County, 1903	Clarksville loam	Huntington silk loam.
	Davidson loam	Hagerstown loam.
3. Giles County, 1907	Davidson loam	Hagerstown loam.
4. Grainger County, 1906	Moccasin stony clay	Hagerstown stony clay.
	Newman stony loam	Hagerstown stony loam.
	Clinch shale loam	Dekalb shale loam.
	Grainger shale loam	Conasauga shale loam.
5. Greeneville area, 1904	Fort Payne stony loam	Clarksville stony loam.
	Fort Payne clay	Conestoga clay.
	Fort Payne loam	Hagerstown loam.
	Decatur clay	Hagerstown clay.
6. Henderson County, 1905.		
7. Lawrence County, 1904	Clarksville loam	Wabash silt loam.
	Clarksville clay loam	Hagerstown loam.
8. Madison County, 1906.		
9. Montgomery County, 1901	Clarksville loam	Huntington silt loam.
10. Overton County, 1908.		
11. Pikeville area, 1903	Clarksville loam	Huntington silt loam.
	Dekalb clay loam	Lickdale clay loam.
12. Sumner County, 1909.		
Texas.		
1. Anderson County, 1904	Yazoo sandy loam	Trinity fine sandy loam.
	Houston clay	Houston black clay.
	Yazoo clay	Trinity clay.
2. Austin area, 1904	Austin clay	Houston clay.
	Lufkin fine sandy loam	Susquehanna fine sandy loam.
	Yazoo clay	Trinity clay.
	Yazoo sandy loam	Miller fine sandy loam.
3. Bastrop County, 1907	Wabash clay	Trinity clay.
4. Brazoria area, 1902	Galveston sand	Coastal beach.
	Galveston clay	Tidal marsh.
	Yazoo clay	Miller clay.
	Calcasieu fine sandy loam.	Caddo fine sandy loam.
	Yazoo sandy loam	Pledger silt loam.
	Sharkey clay	Trinity clay.
5. Brownsville area, 1907.		
6. Camp County, 1908.		
7. Cooper area, 1907	Wabash clay	Trinity clay.
8. Corpus Christi area, 1908	Corpus Christi clay	Trinity clay.
9. Franklin County, 1908	Wabash clay	Trinity clay.
10. Grayson County, 1909.		
11. Henderson area, 1906.		
12. Houston County, 1905	Yazoo sandy loam	Trinity sandy loam.
	Wabash clay	Trinity clay.
	Yazoo loam	Trinity loam.
13. Jacksonville area, 1903.		
14. Laredo area, 1906.		
15. Lee County, 1905.		
16. Lavaca County, 1905.		
17. Lufkin area, 1903.		
18. Morris County, 1909.		
19. Nacogdoches area, 1903.		

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
Texas—Continued.		
20. Paris area, 1903	Houston silt loam	Houston loam.
	Houston clay	Houston loam.
	Vernon fine sand	Miller fine sand.
	Orangeburg silt loam	Miller silt loam.
21. Robertson County, 1907	Wabash clay	Trinity clay.
22. San Antonio area, 1904	Austin clay	Houston clay.
	Norfolk silt loam	Crockett loam.
23. San Marcos area, 1906	Wabash clay	Trinity clay.
24. Titus County, 1909.		
25. Vernon area, 1902	Vernon silt loam	Miller silt loam.
26. Waco area, 1905	Miller heavy clay	Miller clay.
	Yazoo heavy clay	Trinity clay.
	Yazoo clay	Trinity clay.
27. Willis area, 1901	San Jacinto clay	Houston black clay.
	Willis sand	Norfolk fine sandy loam.
28. Wilson County, 1907	Wabash clay	Trinity clay.
29. Woodville area, 1903.		
Vermont.		
1. Vergennes area, 1904	Alton stony loam	Adirondack stony sandy loam.
Virginia.		
1. Albemarle area, 1902	Cecil loam	Chester loam.
	Edgemont stony loam	Dekalb stony loam.
	Hagerstown shale loam	Dekalb shale loam.
2. Appomattox County, 1904	Cecil loam	York loam.
	Cecil sand	Durham sandy loam.
3. Bedford area, 1901	Hagerstown shale loam	Dekalb shale loam.
	Porters red clay	Porters clay.
	Murrill stony loam	Hagerstown stony loam.
	Murrill sandy loam	Hagerstown sandy loam.
4. Campbell County, 1909.		
5. Chesterfield County, 1906.		
6. Hanover County, 1905	Cecil sand	Durham sandy loam.
7. Leesburg area, 1903	Loudoun sandy loam	Chester sandy loam.
	Cecil mica loam	Manor loam.
	Cecil loam	Chester loam.
	Cecil silt loam	Lansdale silt loam.
8. Louisa County, 1905	Cecil sand	Durham sandy loam.
	Cecil fine sandy loam	Louisa fine sandy loam.
	Cecil loam	Louisa loam.
9. Montgomery County, 1907	Pilot gravelly loam	Talladega gravelly loam.
	Pilot loam	Talladega loam.
	Radford loam	Cumberland loam.
	Indian loam	Chandler loam.
10. Norfolk area, 1903	Galveston sand	Coastal beach.
	Norfolk sand	Norfolk fine sand.
	Leonardtown gravelly loam.	Portsmouth silt loam.
	Leonardtown loam	Portsmouth silt loam.
	Norfolk loam	Sassafras sandy loam.
11. Prince Edward area, 1901.		
12. Yorktown area, 1905	Galveston sand	Coastal beach.
	Galveston clay	Tidal marsh.
West Virginia.		
1. Leesburg area, Virginia, 1903.	Cecil loam	Chester loam.
	Hagerstown shale loam	Dekalb shale loam.

Areas surveyed and changes which have been made, etc.—Continued.

Name of area.	Soil name as published.	Changed to—
West Virginia—Continued.		
2. Middlebourne area, 1907.		
3. Parkersburg area, 1908.		
4. Spencer area, 1909.		
5. Upshur County, 1905.		
6. Wheeling area, 1906.		
Wisconsin.		
2. Janesville area, 1902	Janesville loam	Sioux silt loam.
	Miami loam	Sioux sandy loam.
	Edgerton silt loam	Miami silt loam.
	Janesville silt loam	Carrington silt loam.
	Miami black clay loam	Carrington silt loam.
	Mackinaw gravel	Judson gravel.
	Afton fine sandy loam	Coloma sand.
	Hanover sand	Coloma sandy loam.
3. Portage County, 1905	Miami stony sand	Coloma stony sand.
	Miami sandy loam	Coloma sandy loam.
	Miami stony loam	Miami loam.
	Miami sand	Coloma sand.
	Marshall sand	Plainfield sand.
	Marshall gravelly loam	Waukesha sandy loam.
4. Racine County, 1906	Miami gravel	Coloma gravel.
	Marshall clay loam	Carrington clay loam.
	Marshall loam	Waukesha loam.
5. Superior area, 1904	Miami sandy loam	Coloma sandy loam.
	Miami sand	Coloma sand.
6. Viroqua area, 1903	Miami loam	Wabash loam.
	Miami sand	Coloma sand.
	Miami sandy loam	Coloma sandy loam.
	Miami silt loam	Knox silt loam.
7. Waushara County, 1909.		
8. Carlton area, Minnesota, 1905.		

List of changes in the correlation of soils.

Name as published.	Changed to—	Name of area.
Afton fine sandy loam	Coloma sand	Janesville area, Wis.
Alamance silt loam	York silt loam	Alamance County, N. C.
Allegan black clay	Clyde loam	Allegan County, Mich.
Allegan clay	Miami clay loam	Allegan County, Mich.
Allegan gravelly loam	Coloma gravelly sand	Allegan County, Mich.
	Coloma gravelly sandy loam.	Pontiac area, Mich.
Allegan sand	Coloma sand	Allegan County, Mich.
Allegan fine sandy loam	Coloma fine sand	Allegan County, Mich.
Allegan sandy loam	Coloma sandy loam	Allegan County, Mich.
Allegan stony loam	Miami loam	Allegan County, Mich.
Alloway clay	Dunkirk clay	Lyons area, N. Y.
		Syracuse area, N. Y.
Almyra silt loam	Crowley silt loam	Stuttgart area, Ark.
Alton stony loam	Adirondack stony sandy loam.	Vergennes area, N. Y.
		Vergennes area, Vt.
	Dunkirk stony loam	Lyons area, N. Y.
		Syracuse area, N. Y.
	Plymouth sandy loam	Long Island area, N. Y.
		Rhode Island.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Arkansas fine sandy loam.	Wabash fine sandy loam.	Stanton area, Nebr.
Austin clay	Houston clay	Austin area, Tex.
		San Antonio area, Tex.
Ayden fine sandy loam	Norfolk fine sandy loam.	Darlington area, S. C.
Barnum loam	Superior loam	Carlton area, Minn.
Barnum stony loam	Superior stony loam	Carlton area, Minn.
Benoit loam	Fargo loam	Crookston area, Minn.
Benton loam	Houston clay	Russell area, Kans.
Bloomfield sandy loam	Knox sandy loam	Greene County, Ind.
Brandywine loam	Manor loam	Chester County, Pa.
Calcasieu fine sand	Caddo fine sand	Lake Charles area, La.
Calcasieu fine sandy loam.	Caddo fine sandy loam	Lake Charles area, La.
		Brazoria area, Tex.
Calcasieu loam	Caddo loam	Lake Charles area, La.
Carrington clay loam	Wabash clay loam	Carrington area, N. Dak.
Cassadaga sand	Meadow	Westfield area, N. Y.
Caswell sandy loam	Rough broken land	Caswell County, N. C.
Cecil clay	Cecil stony loam	Lebanon area, Pa.
Cecil clay loam	Montalto clay loam	Adams County, Pa.
		Montgomery County, Pa.
Cecil fine sandy loam	Louisa fine sandy loam.	Cherokee County, S. C.
		Louisa County, Va.
	York fine sandy loam	Lancaster County, S. C.
		York County, S. C.
Cecil loam	Cecil stony loam	Trenton area, N. J.
	Chester loam	Cecil County, Md.
		Harford County, Md.
		Leesburg area, Md.
		Adams County, Pa.
		Albemarle area, Va.
		Leesburg area, Va.
		Leesburg area, W. Va.
	York loam	Appomattox County, Va.
	Louisa loam	Louisa County, Va.
Cecil mica loam	Manor loam	Cecil County, Md.
		Harford County, Md.
		Leesburg area, Md.
		Prince George County, Md.
		Lancaster area, Pa.
		Leesburg area, Va.
Cecil sand	Durham sandy loam	Spalding County, Ga.
		Campobello area, S. C.
		Cherokee County, S. C.
		York County, S. C.
		Appomattox County, Va.
		Hanover County, Va.
		Louisa County, Va.
Cecil silt loam	Lansdale silt loam	Leesburg area, Va.
	Louisa silt loam	Cherokee County, S. C.
	York silt loam	Lancaster County, S. C.
		York County, S. C.
Cecil slate loam	Louisa slate loam	Tallapoosa County, Ala.
Cecil stony loam	Montalto stony loam	Montgomery County, Pa.
Chattooga loam	Holston loam	Fort Payne area, Ala.
Chester mica loam	Manor loam	Montgomery County, Pa.
Chicopee gravel loam	Merrimac gravelly sandy loam.	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Clarksville clay	Elk clay	Huntsville area, Ala.
Clarksville clay loam	Hagerstown loam	Lauderdale County, Ala.
		Lawrence County, Tenn.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Clarksville loam	Huntington silt loam	Fort Payne area, Ala.
		Lauderdale County, Ala.
		Warren County, Ky.
		Webster County, Mo.
		Davidson County, Tenn.
		Lawrence County, Tenn.
		Montgomery County, Tenn.
		Pikeville area, Tenn.
	Wabash silt loam	Howell County, Mo.
		Saline County, Mo.
Clarksville stony loam	Rough stony land	Wichita area, Kans.
		Dubuque area, Ill.
		Dubuque area, Iowa.
Clinch shale loam	Dekalb shale loam	Grainger County, Tenn.
Connecticut meadows	Podunk silt loam	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Connecticut swamp	Swamp	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Corpus Christi clay	Trinity clay	Corpus Christi area, Tex.
Dauphin sandy loam	Dekalb sandy loam	Lebanon area, Pa.
Davidson loam	Hagerstown loam	Davidson County, Tenn.
		Giles County, Tenn.
Davie clay loam	Louisa fine sandy loam	Abbeville area, S. C.
	Louisa loam	Statesville area, N. C.
Decatur clay	Hagerstown clay	Greenville area, Tenn.
Dekalb clay loam	Lickdale clay loam	Pikeville area, Tenn.
Delevan silt loam	Sioux silt loam	Tazewell County, Ill.
Donegal gravelly loam	Norfolk gravelly loam	Lancaster area, Pa.
		Lebanon area, Pa.
Dunkirk gravelly loam	Dunkirk gravelly sandy loam.	Ashtabula area, Ohio.
		Westfield area, N. Y.
Dunkirk sandy loam	Dunkirk fine sandy loam.	Ashtabula area, Ohio.
		Westfield area, N. Y.
Dunkirk shale loam	Dekalb clay	Westfield area, N. Y.
Durham fine sandy loam.	York fine sandy loam	Saluda County, S. C.
Edgemont stony loam	Dekalb stony loam	Lancaster area, Pa.
		Lebanon area, Pa.
		Albemarle area, Va.
Edgerton silt loam	Miami silt loam	Clinton County, Ill.
		Janesville area, Wis.
Elkhorn silt loam	Wabash silt loam	Stanton area, Nebr.
Elkton clay	Elkton silt loam	Dover area, Del.
		Cecil County, Md.
		Harford County, Md.
		Kent County, Md.
		Prince Georges County, Md.
		Worcester County, Md.
		Salem area, N. J.
	Holly clay loam	Mason County, Ky.
Elmira fine sandy loam	Genesee fine sandy loam.	Bigflats area, N. Y.
Elmira shale loam	Dunkirk shale loam	Bigflats area, N. Y.
Elmira silt loam	Dunkirk silt loam	Bigflats area, N. Y.
		Lyons area, N. Y.
Elmwood loam	Suffield loam	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Enfield sandy loam	Manchester fine sand	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Elsinboro fine sand	Sassafras fine sand	Trenton area, N. J.
		Trenton area, Pa.
	Sassafras fine sandy loam	Salem area, N. J.
Fairview sandy loam	Marshall sandy loam	Marshall area, Minn.
Fort Payne clay	Conestoga clay	Greeneville area, Tenn.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Fort Payne loam	Hagerstown loam	Greeneville area, Tenn.
Fort Payne sandy loam	Dover fine sandy loam	Munising area, Mich.
Fort Payne stony loam	Clarksville stony loam	Blount County, Ala.
		Fort Payne area, Ala.
		Greeneville area, Tenn.
Galveston clay	Tidal marsh	Dover area, Del.
		New Orleans area, La.
		Worcester County, Md.
		Long Island area, N. Y.
		Charleston area, S. C.
		Brazoria area, Tex.
		Yorktown area, Va.
		New Hanover County, N. C.
Galveston fine sand	Coastal beach	New Hanover County, N. C.
		Rhode Island.
		Charleston County, S. C.
Galveston sand	Coastal beach	Dover area, Del.
		Escambia County, Fla.
		Worcester County, Md.
		Long Island area, N. Y.
		New Hanover County, N. C.
		Brazoria area, Tex.
		Norfolk area, Va.
		Yorktown area, Va.
Galveston sandy loam	Tidal marsh	Long Island area, N. Y.
		Rhode Island.
Garner stony loam	Susquehanna gravelly loam.	Raleigh to Newbern, N. C.
Gloucester stony loam	Rough stony land	Rhode Island.
Goldsboro compact sandy loam.	Portsmouth sandy loam.	Raleigh to Newbern, N. C.
		Darlington area, S. C.
Grainger shale loam	Conasauga shale loam	Grainger County, Tenn.
Guthrie clay	Waverly clay loam	Posey County, Ind.
Hagerstown shale loam	Dekalb shale loam	Lancaster area, Pa.
		Lebanon area, Pa.
		Lockhaven area, Pa.
		Albemarle area, Va.
		Bedford area, Va.
		Leesburg area, Md.
		Leesburg area, W. Va.
	Volusia silt loam	Bigflats area, N. Y.
Hagerstown silt loam	Clarksville silt loam	Huntsville area, Ala.
Hanover sand	Coloma sandy loam	Janesville area, Wis.
Hempfield stony loam	Cecil stony loam	Lancaster area, Pa.
Hempstead gravelly loam.	Sassafras loam	Long Island area, N. Y.
Hempstead loam	Sassafras loam	Long Island area, N. Y.
Herndon stony loam	Porters stony loam	Cobb County, Ga.
		Alamance County, N. C.
		Statesville area, N. C.
Hillsboro silt loam	Clarksville silt loam	Coffee County, Tenn.
Hobart clay	Rough broken land	Carrington area, N. Dak.
		Jamestown area, N. Dak.
Houston black clay	Houston clay	Macon County, Ala.
Houston clay	Houston black clay	Anderson County, Tex.
	Houston loam	Paris area, Tex.
Houston silt loam	Houston loam	Paris area, Tex.
Huntington fine sandy loam.	Wabash loam	Greene County, Ind.
Huntington loam	Genesee loam	Madison County, N. Y.
		Niagara County, N. Y.
	Wabash loam	Marion County, Ind.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Huntington silt loam	Ondawa silt loam	Dutchess County, N. Y.
	Wabash silt loam	Greene County, Ind.
Hyde mucky loam	Muck (Hyde mucky loam).	Lake Mattamuskeet, N. C.
Indian loam	Chandler loam	Montgomery County, Va.
Janesville loam	Sioux silt loam	Janesville area, Wis.
Janesville silt loam	Carrington silt loam	Janesville area, Wis.
Kalamazoo gravelly loam	Clyde gravelly sand	Allegan County, Mich.
Kaskaskia loam	Wabash silt loam	Clinton County, Ill.
		Knox County, Ill.
		McLean County, Ill.
		Sangamon County, Ill.
		St. Clair County, Ill.
		Newton County, Ind.
		Tama County, Iowa.
King clay	Colbert clay	Colbert County, Ala.
King clay loam	Colbert clay loam	Colbert County, Ala.
Leighton loam	Clarksville loam	Colbert County, Ala.
Leonardtown gravelly loam	Leonardtown loam	Prince George County, Md.
Leonardtown loam	Portsmouth silt loam	Norfolk area, Va.
	Portsmouth silt loam	Norfolk area, Va.
	Huntington silt loam	Mason County, Ky.
Lintonia loam	Lintonia silt loam	St. Clair County, Ill.
		Holmes County, Miss.
		Montgomery County, Miss.
		Smedes area, Miss.
		Yazoo area, Miss.
	Wabash loam	Tazewell County, Ill.
	Wabash silt loam	Dubuque area, Ill.
		Dubuque area, Iowa.
Loudoun sandy loam	Chester sandy loam	Leesburg area, Md.
		Leesburg area, Va.
Lufkin clay	Susquehanna clay	Macon County, Ala.
Lufkin clay loam	Lufkin clay	Sumter County, Ala.
Lufkin fine sandy loam	Susquehanna fine sandy loam.	Austin area, Tex.
McLean silt loam	Marshall loam	McLean County, Ill.
McLeod sand	Dunkirk sand	Crookston area, Minn.
		Ransom County, N. Dak.
Mackinaw gravel	Judson gravel	Tazewell County, Ill.
		Janesville area, Wis.
Madison loam	Sioux clay loam	Madison County, Ind.
Mankato sand	Sioux sand	Blue Earth County, Minn.
Marco clay loam	Wabash clay loam	Greene County, Ind.
Marco fine sandy loam	Lintonia fine sandy loam	Greene County, Ind.
Marshall clay	Fargo clay	Fargo area, N. Dak.
Marshall clay loam	Carrington clay loam	Cerro Gordo County, Iowa.
		Story County, Iowa.
		Blue Earth County, Minn.
		Ransom County, N. Dak.
		Racine County, Wis.
Marshall fine sand	Waukesha sand	Newton County, Ind.
Marshall fine sandy loam	Carrington fine sandy loam.	Blue Earth County, Minn.
		Ransom County, N. Dak.
		Newton County, Ind.
Marshall gravel	Coloma gravelly sand	Pontiac area, Mich.
	Carrington gravel	Marshall area, Minn.
		Cando area, N. Dak.
Marshall gravelly loam	Carrington gravelly loam	Brown County, Kans.
		Marshall area, Minn.

List of changes in the correlation of soils—Continued.

Name as published.	Charged to—	Name of area.
Marshall gravelly loam...	Carrington gravelly loam	Carrington area, N. Dak.
		Ransom County, N. Dak.
	Fargo gravelly loam.....	Fargo area, N. Dak.
	Waukesha sandy loam..	Portage County, Wis.
Marshall gravelly sandy loam.	Carrington gravelly sandy loam.	Richland County, N. Dak.
Marshall loam.....	Carrington loam.....	Marshall County, Ind.
		Newton County, Ind.
		Cerro Gordo County, Iowa.
		Story County, Iowa.
		Tama County, Iowa.
		Cass County, Mich.
		Blue Earth County, Minn.
		Marshall area, Minn.
		Lancaster County, Nebr.
		Cando area, N. Dak.
		Carrington area, N. Dak.
		Jamestown area, N. Dak.
		Richland County, N. Dak.
	Carrington silt loam.....	Brookings area, S. Dak.
	Fargo loam.....	Fargo area, N. Dak.
	Carrington silt loam.....	Tippecanoe County, Ind.
	Waukesha loam.....	Racine County, Wis.
Marshall sand.....	Plainfield sand.....	Portage County, Wis.
	Waukesha sand.....	Marshall County, Ind.
		Cerro Gordo County, Iowa.
Marshall sandy loam.....	Carrington sandy loam..	Brown County, Kans.
		Brookings area, S. Dak.
	Waukesha sandy loam...	Marshall County, Ind.
Marshall silt loam.....	Carrington silt loam.....	Blue Earth County, Minn.
		Carrington area, N. Dak.
		Jamestown area, N. Dak.
Marshall stony loam.....	Carrington stony loam...	Carrington area, N. Dak.
		Jamestown area, N. Dak.
		Ransom County, N. Dak.
		Brookings area, S. Dak.
Memphis silt loam.....	Lintonia silt loam.....	Posey County, Ind.
		Union County, Ky.
Merrimac gravelly loam...	Fishkill gravelly loam...	Dutchess County, N. Y.
Merrimac gravelly sandy loam.	Fishkill gravelly sandy loam.	Dutchess County, N. Y.
Merrimac loam.....	Fishkill loam.....	Dutchess County, N. Y.
Miami black clay loam....	Carrington black clay loam.	Allen County, Ind.
		Madison County, Ind.
		Marion County, Ind.
		Marshall County, Ind.
		Newton County, Ind.
		Cerro Gordo County, Iowa.
		Oxford area, Mich.
		Pontiac area, Mich.
		Jamestown area, N. Dak.
		Auglaize County, Ohio.
		Columbus area, Ohio.
		Montgomery County, Ohio.
		Westerville area, Ohio.
	Carrington silt loam.....	Janesville area, Wis.
	Clyde clay.....	Toledo area, Ohio.
		Toledo area, Mich.
	Fargo clay loam.....	Fargo area, N. Dak.
		Brookings area, S. Dak.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Miami black clay loam...	Fargo loam.....	Marshall area, Minn.
	Fargo silt loam.....	Grand Forks area, N. Dak.
	Marshall black clay loam.	Knox County, Ill.
		McLean County, Ill.
		Sangamon County, Ill.
		Tazewell County, Ill.
		Tippecanoe County, Ind.
	Wabash clay loam.....	Story County, Iowa.
Miami clay loam.....	Crowley silt loam.....	Stuttgart area, Ark.
	Dunkirk clay loam.....	Toledo area, Ohio.
Miami fine sand.....	Coloma fine sand.....	Winnebago County, Ill.
		Cass County, Mich.
		Carlton area, Minn.
	Dunkirk fine sand.....	Newton County, Ind.
		Owosso area, Mich.
		Saginaw area, Mich.
		Auburn area, N. Y.
		Lyons area, N. Y.
		Madison County, N. Y.
		Syracuse area, N. Y.
	Knox fine sand.....	Sangamon County, Ill.
		Tazewell County, Ill.
		Tippecanoe County, Ind.
		Tama County, Iowa.
		Stanton area, Nebr.
	Laurel fine sand.....	Wichita area, Kans.
	Lintonia fine sand.....	O'Fallon area, Ill.
		O'Fallon area, Mo.
		Dubuque area, Ill.
Miami fine sandy loam ...	Coloma fine sandy loam.	Cass County, Mich.
	Dunkirk fine sandy loam	Lyons area, N. Y.
		Madison County, N. Y.
		Syracuse area, N. Y.
	Knox fine sandy loam...	Tippecanoe County, Ind.
	Lintonia fine sandy loam	Boonville area, Ind.
	Memphis silt loam.....	St. Clair County, Ill.
	Waverly fine sandy loam.	Posey County, Ind.
		Union County, Ky.
Miami gravel.....	Coloma gravel.....	Racine County, Wis.
	Judson gravel.....	Winnebago County, Ill.
Miami gravelly loam.....	Chenango gravelly loam.	Marion County, Ind.
		Pontiac area, Mich.
		Columbus area, Ohio.
		Coshocton area, Ohio.
		Montgomery County, Ohio.
		Westerville area, Ohio.
		Wooster area, Ohio.
Miami gravelly loam.....	Dunkirk gravelly loam..	Bigflats area, N. Y.
		Syracuse area, N. Y.
Miami gravelly sand.....	Coloma gravelly sand...	Oxford area, Mich.
	Coloma gravelly sandy loam.	Alma area, Mich.
	Dunkirk gravelly sand..	Saginaw area, Mich.
		Owosso area, Mich.
Miami gravelly sandy loam.	Coloma gravelly sandy loam.	Marshall County, Ind.
		Tippecanoe County, Ind.
		Cass County, Mich.
		Oxford area, Mich.
		Carlton area, Minn.
Miami loam.....	Fargo fine sandy loam..	Fargo area, N. Dak.
	Fargo loam.....	Grand Forks area, N. Dak.

List of changes in the correlation of soils—Continued.

Name as published.	Charged to—	Name of area.
Miami loam	Genesee loam	Auburn area, N. Y.
		Lyons area, N. Y.
		Syracuse area, N. Y.
	Miami silt loam	Tippecanoe County, Ind.
	Sioux loam	Tazewell County, Ill.
		Marion County, Ind.
	Sioux sandy loam	Janesville area, Wis.
	Wabash loam	Pontiac area, Mich.
		Marshall area, Minn.
		Columbus area, Ohio.
		Coshocton area, Ohio.
		Montgomery County, Ohio.
		Toledo area, Ohio.
		Westerville area, Ohio.
		Viroqua area, Wis.
Miami sand	Coloma fine sand	Oxford area, Mich.
	Coloma sand	Marshall area, Ind.
		Alma area, Mich.
		Cass County, Mich.
		Munising area, Mich.
		Owosso area, Mich.
		Pontiac area, Mich.
		Saginaw area, Mich.
		Wexford County, Mich.
		Carlton area, Minn.
		Wooster area, Ohio.
		Portage County, Wis.
		Superior area, Wis.
		Viroqua area, Wis.
	Dunkirk sand	Toledo area, Ohio.
	Knox sand	Greene County, Ind.
		Posey County, Ind.
		Grand Island area, Nebr.
	Laurel sand	Wichita area, Kans.
Miami sandy loam	Fargo fine sandy loam	Grand Forks area, N. Dak.
	Wabash fine sandy loam	Posey County, Ind.
	Coloma sandy loam	Cass County, Mich.
		Munising area, Mich.
		Oxford area, Mich.
		Pontiac area, Mich.
		Carlton area, Minn.
		Portage County, Wis.
		Superior area, Wis.
		Viroqua area, Wis.
	Dunkirk sandy loam	Toledo area, Ohio.
		Toledo area, Mich.
		Wooster area, Ohio.
	Knox sandy loam	Dubuque area, Iowa.
	Sioux sandy loam	Marion County, Ind.
	Wabash sandy loam	Montgomery County, Ohio.
Miami silt loam	Carver silt loam	Rhode Island.
	Dunkirk silt loam	Syracuse area, N. Y.
	Knox silt loam	Knox County, Ill.
		McLean County, Ill.
		O'Fallon area, Ill.
		Sangamon County, Ill.
		Winnebago County, Ill.
		Boonville area, Ind.
		Greene County, Ind.
		Posey County, Ind.
		Tippecanoe County, Ind.
		Tama County, Iowa.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Miami silt loam	Knox silt loam	Dubuque area, Ill.
		Dubuque area, Iowa.
		Union County, Ky.
		O'Fallon area, Mo.
		Saline County, Mo.
		Sarpy County, Nebr.
		Viroqua area, Wis.
	Marshall silt loam	Clinton County, Ill.
		St. Clair County, Ill.
Miami stony loam	Cazenovia loam	Madison County, N. Y.
		Syracuse area, N. Y.
	Flushing loam	Long Island area, N. Y.
		Rhode Island.
	Miami loam	Cass County, Mich.
		Carlton area, Minn.
		Cleveland area, Ohio.
		Wooster area, Ohio.
		Portage County, Wis.
	Ontario loam	Auburn area, N. Y.
		Lyons area, N. Y.
		Tompkins County, N. Y.
Miami stony sand	Coloma stony sand	Portage County, Wis.
Miller heavy clay	Miller clay	Waco area, Tex.
Moccasin stony clay	Hagerstown stony clay	Grainger County, Tenn.
Monroe fine sandy loam	Miller fine sandy loam	Ouachita area, La.
Murrill sandy loam	Hagerstown sandy loam	Bedford area, Va.
Murrill stony loam	Hagerstown stony loam	Bedford area, Va.
Nellis loam	Hagerstown loam	Montgomery County, N. Y.
Neuse clay	Congaree clay	McNeill area, Miss.
		Craven area, N. C.
		Raleigh to Newbern, N. C.
Newman stony loam	Hagerstown stony loam	Grainger County, Tenn.
Norfolk clay	Cahaba clay	Dallas County, Ala.
		Montgomery County, Ala.
Norfolk coarse sand	Carver coarse sand	Long Island area, N. Y.
		Rhode Island.
Norfolk coarse sandy loam	Carver coarse sandy loam	Long Island area, N. Y.
	Merrimac coarse sandy loam	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Norfolk fine sandy loam	Cumberland fine sandy loam	Mason County, Ky.
Norfolk gravel	Susquehanna gravel	Long Island area, N. Y.
Norfolk loam	Cumberland sandy loam	Mason County, Ky.
	Huntington fine sandy loam	Lockhaven area, Pa.
	Kalmia loam	Lamar County, Ala.
	Sassafras fine sandy loam	Prince George County, Md.
		St. Marys County, Md.
	Sassafras loam	Calvert County, Md.
	Sassafras sandy loam	Dover area, Del.
		Norfolk area, Va.
Norfolk sand	Norfolk fine sand	Craven area, N. C.
		Norfolk area, Va.
		Perry County, Ala.
	Sassafras sand	Cecil County, Md.
		Harford County, Md.
		Kent County, Md.
		St. Marys County, Md.
		Salem area, N. J.
		Long Island area, N. Y.
Norfolk sandy loam	Norfolk fine sandy loam	Fort Valley area, Ga.
	Tifton sandy loam	Dodge County, Ga.

List of changes in the correlation of soils—Continued.

Name as published—	Changed to—	Name of area.
Norfolk sandy soil	Norfolk sandy loam	Raleigh to Newbern, N. C.
		Darlington area, S. C.
Norfolk silt loam	Crockett loam	San Antonio area, Tex.
	Huntington loam	Lockhaven area, Pa.
	Kalmia silt loam	Marion County, Ala.
	Norfolk loam	Chowan County, N. C.
	Sassafras silt loam	Dover area, Del.
		Chester County, Pa.
Oakland sandy loam	Miami fine sandy loam	Pontiac area, Mich.
Ocklocknee clay	Congaree clay	Macon County, Ala.
Orangeburg loam	Greenville loam	Escambia County, Fla.
		Jasper County, Miss.
	Orangeburg sandy loam	Darlington area, S. C.
Orangeburg sandy loam	Orangeburg fine sandy loam	Perry County, Ala.
		Gadsden County, Fla.
		Fort Valley area, Ga.
	Orangeburg sand	Darlington area, S. C.
Orangeburg silt loam	Miller silt loam	Paris area, Tex.
Oswego silt loam	Neosho silt loam	Parsons area, Kans.
Penn clay	Upshur clay	Syracuse area, N. Y.
Penn sandy loam	Upshur sandy loam	Fort Payne area, Ala.
Pilot gravelly loam	Talladega gravelly loam	Montgomery County, Va.
Pilot loam	Talladega loam	Oconee County, S. C.
		Montgomery County, Va.
Plainwell stony loam	Coloma stony sand	Allegan County, Mich.
		Pontiac area, Mich.
	Plymouth stony sand	Long Island area, N. Y.
Pocoson	Swamp	Raleigh to Newbern, N. C.
Porters red clay	Porters clay	Bedford area, Va.
Portsmouth clay	Portsmouth loam	Craven area, N. C.
Portsmouth silt loam	Elkton silt loam	Chester County, Pa.
Quinton sandy loam	Norfolk sandy loam	Salem area, N. J.
		Trenton area, N. J.
Radford loam	Cumberland loam	Montgomery County, Va.
Rhinebeck loam	Hudson silt loam	Dutchess County, N. Y.
Saginaw sandy loam	Clyde sandy loam	Owosso area, Mich.
		Saginaw area, Mich.
San Jacinto clay	Houston black clay	Willis area, Tex.
Sassafras loam	Cahaba fine sandy loam	Darlington area, S. C.
	Sassafras silt loam	Calvert County, Md.
		Cecil County Md.
		Harford County, Md.
		Kent County, Md.
		Prince George County, Md.
		St. Marys County, Md.
		Salem area, N. J.
		Trenton area, N. J.
		Trenton area, Pa.
Sassafras sandy loam	Cahaba sandy loam	Perry County, Ala.
	Sassafras fine sandy loam	Calvert County, Md.
	Sassafras loam	Long Island area, N. Y.
Savanna	Swamp	Raleigh to Newbern, N. C.
Selma clay	Cahaba clay	Fort Valley area, Ga.
		Craven area, N. C.
Selma heavy silt loam	Portsmouth fine sandy loam	Raleigh to Newbern, N. C.
	Portsmouth sandy loam	Darlington area, S. C.
Selma silt loam	Norfolk sandy loam	Raleigh to Newbern, N. C.
Sharkey clay	Miller clay	Miller County, Ark.
	Wabash clay	Allen County, Kans.
		Parsons area, Kans.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Sharkey clay	Waverly clay	Union County, Ky.
	Trinity clay	Brazoria area, Tex.
Shelby clay	Shelby loam	Shelby County, Mo.
Shelby sand	Mankato sand	Shelby County, Mo.
Shelby silt loam	Putnam silt loam	Scotland County, Mo.
		Shelby County, Mo.
		Putnam County, Mo.
Sturgis fine sandy loam	Lintonia fine sandy loam.	Union County, Ky.
Susquehanna gravel	Norfolk gravel	Calvert County, Md.
		Cecil County, Md.
		Harford County, Md.
		Kent County, Md.
		Prince George County, Md.
		St. Marys County, Md.
		Trenton area, N. J.
Tazewell silt loam	Knox silt loam	Tazewell County, Ill.
Triassic stony loam	Wethersfield loam	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
Upshur loam	Decatur loam	Blount County, Ala.
Vernon fine sand	Miller fine sand	Paris area, Tex.
Vernon silt loam	Miller silt loam	Vernon area, Tex.
Volusia sandy loam	Volusia loam	Westfield area, N. Y.
Wabash clay	Huntington clay	Jefferson County, Ala.
		Conway County, Ark.
	Trinity clay	Oktibbeha County, Miss.
		Bastrop County, Tex.
		Cooper County, Tex.
		Franklin County, Tex.
		Houston County, Tex.
		Robertson County, Tex.
		San Marcos area, Tex.
		Wilson County, Tex.
Wabash clay loam	Huntington clay loam	Fayetteville area, Ark.
Wabash fine sand	Huntington fine sand	Conway County, Ark.
Wabash fine sandy loam	Huntington fine sandy loam.	Conway County, Ark.
Wabash loam	Genesee loam	Binghamton area, N. Y.
		Tompkins County, N. Y.
	Huntington loam	Fayetteville area, Ark.
Wabash silt clay	Wabash silty clay	Riley County, Kans.
		Oklahoma County, Okla.
Wabash silt loam	Huntington silt loam	Fayetteville area, Ark.
		Conway County, Ark.
		Madison County, Ky.
Waldo loam	Wabash silt loam	Russell area, Kans.
Warren shale loam	Volusia loam	Livingston County, N. Y.
Warsaw sandy loam	Cahaba fine sandy loam.	Sumter County, Ala.
Warwick sandy loam	Carver coarse sandy loam.	Rhode Island.
Waverly clay	Bibb clay	Oktibbeha County, Miss.
Waverly loam	Bibb loam	Lamar County, Ala.
		Oktibbeha County, Miss.
	Ocklocknee loam	Sumter County, Ala.
Waverly silt loam	Bibb silt loam	Bibb County, Ala.
	Wabash silt loam	Posey County, Ind.
		Union County, Ky.
Westphalia sand	Norfolk fine sand	Trenton area, N. J.
	Sassafras fine sand	Prince George County, Md.
	Sassafras sand	Salem area, N. J.
Wheatland sand	Fargo sand	Fargo area, N. Dak.
Wheatland sandy loam	Carrington sandy loam	Fargo area, N. Dak.

List of changes in the correlation of soils—Continued.

Name as published.	Changed to—	Name of area.
Willis sand	Norfolk fine sandy loam.	Willis area, Tex.
Windsor sand	Merrimac coarse sand	Connecticut Valley, Conn.
		Connecticut Valley, Mass.
	Norfolk coarse sand	Calvert County, Md.
		Prince George County, Md.
		St. Marys County, Md.
		Salem area, N. J.
		Trenton area, N. J.
Winnebago sandy loam	Carrington sandy loam	Winnebago County, Ill.
Yazoo clay	Crawford clay	Parsons area, Kans.
	Miller clay	Brazoria area, Tex.
	Trinity clay	Montgomery County, Ala.
		Anderson County, Tex.
		Austin area, Tex.
		Waco area, Tex.
	Wabash clay	Clinton County, Ill.
		Johnson County, Ill.
		O'Fallon area, Ill.
		St. Clair County, Ill.
		Tazewell County, Ill.
		Allen County, Kans.
		East Baton Rouge, La.
		New Orleans area, La.
		Tangipahoa area, La.
		Smedes area, Miss.
		Yazoo area, Miss.
		O'Fallon area, Mo.
		Saline County, Mo.
		Wooster area, Ohio.
	Waverly clay	Posey County, Ind.
		Union County, Ky.
Yazoo coarse sand	Riverwash	East and West Carroll parishes, La.
Yazoo heavy clay	Trinity clay	Waco area, Tex.
Yazoo loam	Waverly loam	Posey County, Ind.
	Trinity loam	Houston County, Tex.
Yazoo sandy loam	Waverly fine sandy loam.	Clay County, Ill.
	Miller fine sandy loam	Austin area, Tex.
	Trinity fine sandy loam.	Anderson County, Tex.
	Trinity sandy loam	Houston County, Tex.
	Pledger silt loam	Brazoria area, Tex.
Yazoo silt loam	Wabash silt loam	Brown County, Kans.

INDEX.

Name.	Soil Province.	Page.
Abernathy silt loam	River Flood Plain	239
Acadia silt loam	Coastal Plains	50
Adirondack stony sandy loam	Glacial and Loessial	122
Allis clay	Appalachian	197
Allis shale loam	do	191
Alloway clay	Coastal Plains	60
Altavista sandy loam	River Flood Plain	215
Amite loam	do	227
Amite sandy loam	do	214
Amory fine sandy loam	do	221
Aroostook loam	do	230
Aroostook sandy loam	do	215
Aroostook silt loam	do	239
Athol loam	Limestone	172
Austin fine sandy loam	River Flood Plain	219
Bangor loam	Glacial and Loessial	108
Bangor sandy loam	do	101
Bangor stony loam	do	126
Bastrop clay	River Flood Plain	247
Bastrop fine sandy loam	do	220
Bastrop sandy loam	do	214
Bastrop silt loam	do	238
Baxter silt loam	Limestone	174
Bearden loam	Glacial Lake	152
Benoit fine sandy loam	do	147
Berks sandy loam	Piedmont	86
Berks shale loam	do	88
Berks silt loam	do	89
Bernardston loam	Glacial and Loessial	109
Bibb clay	River Flood Plain	247
Bibb loam	do	226
Bibb silt loam	do	237
Bienville fine sandy loam	Coastal Plains	40
Birdsboro silt loam	River Flood Plain	238
Biscoe silt loam	do	237
Blanco loam	do	229
Boeuf fine sandy loam	Coastal Plains	41
Bradley sandy loam	Piedmont	86
Brennan fine sandy loam	River Flood Plain	222
Brooke clay loam	Limestone	176
Caddo fine sand	Coastal Plains	25
Caddo fine sandy loam	do	36
Caddo loam	do	45
Cahaba clay	River Flood Plain	246
Cahaba fine sand	do	211
Cahaba fine sandy loam	do	218
Cahaba loam	do	226
Cahaba sandy loam	do	214
Cahaba silt loam	do	234
Calhoun clay	River Flood Plain	247
Cameron clay	do	246
Caneadea clay	Glacial Lake	164
Caneadea fine sand	do	138

Name.	Soil Province.	Page.
Caneadea gravelly loam	Glacial Lake	154
Caneadea gravelly sandy loam	do	144
Caneadea loam	do	151
Caneadea silt loam	do	158
Cardiff slate loam	Piedmont	90
Caribou gravelly loam	Glacial and Loessial	123
Caribou loam	do	107
Caribou silt loam	do	115
Caribou stony loam	do	127
Carrington black clay loam	do	118
Carrington clay loam	do	117
Carrington fine sandy loam	do	103
Carrington gravel	do	120
Carrington gravelly loam	do	123
Carrington gravelly sandy loam	do	121
Carrington loam	do	105
Carrington sandy loam	do	100
Carrington silt loam	do	112
Carrington stony loam	do	125
Carroll silt loam	do	114
Carver silt loam	do	116
Carver coarse sand	do	119
Carver coarse sandy loam	do	102
Catalpa silt loam	River Flood Plain	238
Cazenovia loam	Glacial and Loessial	108
Cecil clay	Piedmont	78
Cecil clay loam	do	78
Cecil coarse sandy loam	do	76
Cecil fine sandy loam	do	77
Cecil gravelly loam	do	79
Cecil loam	do	77
Cecil sandy loam	do	76
Cecil stony clay	do	79
Cecil stony loam	do	79
Cecil stony sandy loam	do	79
Chandler loam	Appalachian	189
Chandler stony loam	do	203
Chapman loam	Glacial Lake	149
Chastain fine sand	River Flood Plain	211
Chastain fine sandy loam	do	220
Chemung stony loam	Appalachian	203
Chenango gravelly loam	Glacial Lake	153
Chesterfield gravelly sandy loam	Coastal Plains	65
Chesterfield sandy loam	do	30
Chester fine sandy loam	Piedmont	87
Chester loam	do	87
Chester sandy loam	do	86
Chester stony loam	do	91
Clarksville clay loam	Limestone	177
Clarksville fine sandy loam	do	170
Clarksville gravelly loam	do	173
Clarksville gravelly sandy loam	do	180
Clarksville loam	do	171
Clarksville silt loam	do	173
Clarksville stony loam	do	180
Clyde clay	Glacial Lake	161
Clyde clay loam	do	160
Clyde fine sand	do	137
Clyde fine sandy loam	do	146
Clyde gravelly sand	do	135
Clyde loam	do	148
Clyde sand	do	133
Clyde sandy loam	do	139
Clyde silt loam	do	158

Name.	Soil Province.	Page.
Clyde stony sandy loam	Glacial Lake	144
Coastal beach	Coastal Plains	70
Coastal beach	Glacial Lake	167
Colbert clay	Limestone	179
Colbert clay loam	do	177
Colbert fine sandy loam	do	171
Colbert silt loam	do	174
Collington gravelly sandy loam	Coastal Plains	66
Collington sand	do	21
Collington sandy loam	do	30
Collins silt loam	River Flood Plain	237
Coloma fine sand	Glacial and Loessial	99
Coloma fine sandy loam	do	104
Coloma gravel	do	120
Coloma gravelly sand	do	120
Coloma gravelly sandy loam	do	121
Coloma loam	do	110
Coloma sand	do	97
Coloma sandy loam	do	100
Coloma stony sand	do	121
Colyer silt loam	Appalachian	192
Conasauga clay	do	197
Conasauga shale loam	do	190
Conestoga clay	Limestone	178
Conestoga loam	do	172
Congaree clay	River Flood Plain	246
Congaree fine sandy loam	do	220
Congaree sandy loam	do	213
Congaree loam	do	225
Conowingo barrens	Piedmont	93
Conowingo clay	do	90
Conway silt loam	Appalachian	192
Cossayuna stony loam	Glacial and Loessial	125
Coxville clay	Coastal Plains	61
Coxville clay loam	do	56
Coxville fine sandy loam	do	39
Coxville silt loam	do	52
Coxville very fine sandy loam	do	42
Crockett clay loam	do	55
Crockett fine sandy loam	do	40
Crockett gravelly loam	do	68
Crockett loam	do	46
Crowley silt loam	do	49
Cumberland clay loam	River Flood Plain	242
Cumberland fine sandy loam	do	222
Cumberland gravelly loam	do	231
Cumberland loam	do	226
Cumberland sandy loam	do	216
Cumberland silt loam	do	238
Decatur clay	Limestone	178
Decatur clay loam	do	176
Decatur loam	do	172
Decatur silt loam	do	174
Decatur stony loam	do	181
Decatur stony silt loam	do	175
Dekalb clay	Appalachian	196
Dekalb clay loam	do	195
Dekalb fine sandy loam	do	185
Dekalb gravelly loam	do	199
Dekalb loam	do	187
Dekalb sand	do	198
Dekalb sandy loam	do	180
Dekalb shale loam	do	194
Dekalb silt loam	do	192

Name.	Soil Province.	Page.
Dekalb stony loam	Appalachian	200
Dekalb stony sand	do	198
Dekalb stony sandy loam	do	199
Dekalb stony silt loam	do	193
Dover fine sandy loam	Glacial and Loessial	104
Dover loam	do	109
Dover stony sandy loam	do	123
Dunesand	do	128
Dunesand	Glacial Lake	166
Dunkirk clay	do	162
Dunkirk clay loam	do	159
Dunkirk coarse sand	do	136
Dunkirk fine sand	do	137
Dunkirk fine sandy loam	do	146
Dunkirk gravel	do	134
Dunkirk gravelly loam	do	153
Dunkirk gravelly sand	do	135
Dunkirk gravelly sandy loam	do	143
Dunkirk loam	do	149
Dunkirk sand	do	132
Dunkirk sandy loam	do	140
Dunkirk shale loam	do	156
Dunkirk silt loam	do	157
Dunkirk stony clay	do	164
Dunkirk stony loam	do	155
Durant fine sand	Coastal Plains	26
Durant fine sandy loam	do	38
Durant loam	do	45
Durant sand	do	20
Durham coarse sand	Piedmont	80
Durham coarse sandy loam	do	80
Durham sandy loam	do	81
Dutchess silt loam	Glacial and Loessial	114
Dutchess slate loam	do	127
Dutchess stony loam	do	125
Easton loam	do	109
Edgemont silt loam	Piedmont	83
Elk clay	River Flood Plain	247
Elk loam	do	228
Elkton fine sandy loam	Coastal Plains	39
Elkton loam	do	47
Elkton sandy loam	do	31
Elkton silt loam	do	50
Elmwood loam	Glacial Lake	152
Fargo clay	do	163
Fargo clay loam	do	159
Fargo fine sand	do	137
Fargo fine sandy loam	do	146
Fargo gravelly loam	do	154
Fargo loam	do	149
Fargo sand	do	133
Fargo sandy loam	do	140
Fargo silt loam	do	157
Fayetteville fine sandy loam	Appalachian	186
Fayetteville loam	do	188
Fayetteville stony loam	do	201
Fishkill gravelly loam	Glacial Lake	154
Fishkill gravelly sandy loam	do	143
Fishkill loam	do	152
Flushing loam	Glacial and Loessial	107
Franklin loam	River Flood Plain	230
Frankstown stony loam	Limestone	181
Fort Payne clay loam	do	177
Gadsden loam	Coastal Plains	47

Name.	Soil Province.	Page.
Gadsden sand	Coastal Plains	20
Gadsden sandy loam	do	32
Gainesville sand	do	20
Genesee clay loam	River Flood Plain	242
Genesee fine sandy loam	do	221
Genesee loam	do	225
Genesee silt loam	do	235
Genesee shale loam	do	232
Glenn gravelly loam	Coastal Plains	68
Glenn loam	do	45
Glenn sandy loam	do	30
Gloucester loam	Glacial and Loessial	109
Gloucester stony loam	do	125
Gloucester stony sandy loam	do	122
Grady loam	Coastal Plains	48
Grady fine sandy loam	do	40
Grayson clay loam	do	55
Greenville clay	do	62
Greenville clay loam	do	56
Greenville fine sandy loam	do	39
Greenville fine sand	do	26
Greenville gravelly sandy loam	do	64
Greenville loam	do	46
Greenville loamy sand	do	22
Greenville sandy loam	do	30
Griffin clay	River Flood Plain	248
Guin fine sand	Coastal Plains	26
Guin fine sandy loam	do	35
Guin gravelly sandy loam	do	64
Guin sandy loam	do	31
Guin stony sandy loam	do	66
Guthrie clay	Limestone	178
Guthrie silt loam	do	175
Hagerstown clay	do	178
Hagerstown clay loam	do	176
Hagerstown loam	do	171
Hagerstown sandy loam	do	170
Hagerstown silt loam	do	173
Hagerstown stony clay	do	179
Hagerstown stony loam	do	180
Hamburg silt loam	Glacial and Loessial	116
Hammond silt loam	Coastal Plains	51
Hanceville fine sandy loam	Appalachian	187
Hanceville loam	do	189
Harley sandy loam	Coastal Plains	32
Hartford sandy loam	Glacial Lake	139
Herndon stony loam	Piedmont	80
Hoffman sandy loam	Coastal Plains	32
Hollis stony loam	Glacial and Loessial	126
Holly clay loam	River Flood Plain	242
Holly loam	do	229
Holston fine sandy loam	do	219
Holston gravelly sandy loam	do	217
Holston loam	do	228
Holston silt loam	do	239
Holyoke stony loam	Glacial and Loessial	124
Honeoye stony loam	Glacial Lake	156
Hoosic coarse sand	do	136
Hoosic fine sand	do	138
Hoosic gravel	do	134
Hoosic gravelly sandy loam	do	144
Hoosic silt loam	do	158
Houston black clay	Coastal Plains	63
Houston black clay loam	do	57

Name.	Soil Province.	Page.
Houston chalk	Coastal Plains	71
Houston clay	do	58
Houston clay loam	do	55
Houston gravelly clay	do	62
Houston loam	do	43
Hudson clay loam	Glacial Lake	160
Hudson fine sandy loam	do	147
Hudson loam	do	151
Hudson sandy loam	do	142
Hudson silt loam	do	158
Huntington clay	River Flood Plain	246
Huntington clay loam	do	241
Huntington fine sand	do	211
Huntington fine sandy loam	do	219
Huntington gravelly loam	do	231
Huntington loam	do	225
Huntington sandy loam	do	215
Huntington silty clay	do	249
Huntington silt loam	do	233
Hyde silt loam	Coastal Plains	53
Hyde very fine sandy loam	do	42
Iredell clay loam	Piedmont	84
Iredell fine sandy loam	do	82
Iredell sandy loam	do	81
Iredell stony sandy loam	do	79
Jackson loam	River Flood Plain	230
Judson gravel	Glacial and Loessial	119
Judson loam	do	110
Judson silt loam	do	116
Kalmia coarse sand	River Flood Plain	210
Kalmia fine sand	do	211
Kalmia fine sandy loam	do	219
Kalmia loam	do	228
Kalmia sand	do	209
Kalmia sandy loam	do	214
Kalmia silt loam	do	236
Knox fine sand	Glacial and Loessial	99
Knox fine sandy loam	do	104
Knox sand	do	98
Knox sandy loam	do	101
Knox silt loam	do	112
Lacasine clay loam	Coastal Plains	56
Lake Charles fine sandy loam	do	37
Lake Charles loam	do	47
Lamar loam	do	47
Landry silt loam	do	51
Lansdale silt loam	Piedmont	88
Lansdale stony loam	do	91
Laredo clay	River Flood Plain	248
Laredo clay loam	do	242
Laredo silt loam	do	236
Laredo silty clay	do	249
Laredo silty clay loam	do	243
Leonardtown loam	Coastal Plains	44
Leon fine sand	do	25
Leon sand	do	20
Lexington silt loam	Glacial and Loessial	113
Lickdale clay loam	Appalachian	195
Lickdale stony loam	do	202
Lidgerwood fine sandy loam	Glacial Lake	147
Lintonia fine sand	River Flood Plain	211
Lintonia fine sandy loam	do	220
Lintonia silt loam	do	233
Livingston loam	Glacial Lake	150

Name.	Soil Province.	Page.
Lockport clay	Glacial Lake	163
Locust silt loam	Limestone	175
Lomalta clay	Coastal Plains	60
Louisa fine sandy loam	Piedmont	82
Louisa loam	do	82
Louisa silt loam	do	83
Louisa slate loam	do	80
Lufkin clay	Coastal Plains	59
Lufkin fine sand	do	24
Lufkin fine sandy loam	do	36
Lufkin gravelly loam	do	68
Lufkin loam	do	47
Lufkin sand	do	19
Lufkin sandy loam	do	29
Lufkin silt loam	do	50
Madeland	Appalachian	204
Madeland	Glacial and Loessial	129
Manchester fine sand	Glacial Lake	137
Manchester sandy loam	do	140
Mankato loam	do	152
Mankato sand	do	134
Mankato sandy loam	do	141
Manor loam	Piedmont	87
Manor stony loam	do	91
Mapleton gravelly loam	Glacial and Loessial	124
Marion silt loam	do	112
Marsh	River Flood Plain	251
Marsh	Glacial Lake	167
Marshall black clay loam	Glacial and Loessial	118
Marshall fine sand	do	99
Marshall fine sandy loam	do	103
Marshall loam	do	108
Marshall sandy loam	do	102
Marshall silt loam	do	111
Mattamuskeet fine sand	Coastal Plains	26
Mattamuskeet fine sandy loam	do	39
Mattamuskeet silt loam	do	53
Mattamuskeet very fine sandy loam	do	42
Meadow	River Flood Plain	250
Meigs clay loam	Appalachian	194
Memphis silt loam	Glacial and Loessial	112
Merrimac coarse sand	Glacial Lake	135
Merrimac coarse sandy loam	do	145
Merrimac fine sandy loam	do	147
Merrimac gravelly sandy loam	do	142
Merrimac sand	do	133
Miami clay loam	Glacial and Loessial	117
Miami fine sandy loam	do	103
Miami gravelly loam	do	124
Miami loam	do	106
Miami silt loam	do	114
Miller clay	River Flood Plain	245
Miller fine sand	do	211
Miller fine sandy loam	do	218
Miller loam	do	227
Miller silt loam	do	234
Mobile clay	Coastal Plains	61
Mohawk clay loam	Glacial and Loessial	117
Mohawk loam	do	110
Mohawk silt loam	do	114
Molena sand	Piedmont	80
Montalto clay loam	Appalachian	195
Montalto stony loam	do	202
Monroe silt loam	Coastal Plains	49

Name.	Soil Province.	Page.
Montevallo shale loam	Appalachian	191
Montevallo stony loam	do	202
Montrose clay	Coastal Plains	60
Montrose sandy loam	do	31
Morrison clay loam	Appalachian	195
Morrison fine sandy loam	do	186
Morrison loam	do	188
Morrison sand	do	198
Morrison sandy loam	do	184
Morrison stony loam	do	203
Morse clay	Coastal Plains	61
Moshannon fine sandy loam	River Flood Plain	223
Moshannon loam	do	229
Moshannon silt loam	do	238
Muck	Coastal Plains	71
Muck	River Flood Plain	251
Muck	Glacial and Loessial	128
Muck	Glacial Lake	166
Murrill clay loam	Limestone	177
Myatt clay loam	River Flood Plain	241
Myatt fine sand	do	210
Myatt fine sandy loam	do	218
Myatt sand	do	209
Myatt sandy loam	do	213
Neosho silt loam	River Flood Plain	235
Newton fine sand	Glacial Lake	138
Norfolk clay loam	Coastal Plains	56
Norfolk coarse sand	do	69
Norfolk coarse sandy loam	do	33
Norfolk fine sand	do	23
Norfolk fine sandy loam	do	35
Norfolk gravel	do	64
Norfolk gravelly loam	do	68
Norfolk gravelly sand	do	67
Norfolk gravelly sandy loam	do	66
Norfolk loam	do	44
Norfolk loamy sand	do	22
Norfolk sand	do	18
Norfolk sandy loam	do	28
Norfolk silt loam	do	51
Norfolk very fine sandy loam	do	41
Nueces fine sand	do	25
Nunda stony loam	Glacial and Loessial	127
Ocklocknee clay	River Flood Plain	245
Ocklocknee clay loam	do	240
Ocklocknee fine sandy loam	do	218
Ocklocknee loam	do	224
Ocklocknee sand	do	209
Ocklocknee silt loam	do	235
Oktibbeha clay	Coastal Plains	60
Oktibbeha clay loam	do	54
Oktibbeha fine sandy loam	do	38
Oktibbeha silt loam	do	51
Ondawa fine sand	River Flood Plain	212
Ondawa silt loam	do	234
Ontario loam	Glacial and Loessial	106
Orangeburg clay	Coastal Plains	58
Orangeburg coarse sand	do	69
Orangeburg coarse sandy loam	do	33
Orangeburg fine sand	do	24
Orangeburg fine sandy loam	do	35
Orangeburg gravelly sandy loam	do	65
Orangeburg sand	do	19
Orangeburg sandy loam	do	29

Name.	Soil Province.	Page.
Orono fine sand	Glacial Lake	138
Orono fine sandy loam	do	148
Orono gravelly sandy loam	do	144
Orono silty clay	do	165
Orono silt loam	do	158
Osage clay	River Flood Plain	247
Osage fine sandy loam	do	222
Osage silt loam	do	233
Osage silty clay loam	do	243
Overwash	do	251
Palatine fine sandy loam	Appalachian	187
Palatine silt loam	do	193
Paris loam	do	189
Peat	Coastal Plains	70
Peat	Glacial and Loessial	128
Peat	Glacial Lake	166
Penn clay	Piedmont	90
Penn clay loam	do	89
Penn gravelly loam	do	90
Penn gravelly sandy loam	do	92
Penn loam	do	87
Penn sandy loam	do	85
Penn shale loam	do	88
Penn silt loam	Piedmont	89
Penn stony loam	do	91
Pheba silt loam	Coastal Plains	52
Plainfield sand	Glacial and Loessial	98
Pledger silt loam	River Flood	234
Plymouth sandy loam	Glacial and Loessial	100
Plymouth stony sand	do	121
Podunk fine sandy loam	Glacial Lake	147
Podunk silt loam	do	157
Point Isabel clay	Coastal Plains	61
Portage sandy loam	Glacial and Loessial	101
Portage silt loam	do	115
Portage stony sandy loam	do	122
Porters black loam	Appalachian	189
Porters clay	do	196
Porters clay loam	do	195
Porters fine sandy loam	do	185
Porters loam	do	187
Porters sand	do	197
Porters sandy loam	do	184
Porters stony loam	do	201
Portsmouth clay	Coastal Plains	61
Portsmouth clay loam	do	55
Portsmouth coarse sandy loam	do	33
Portsmouth fine sand	do	24
Portsmouth fine sandy loam	do	35
Portsmouth loam	do	45
Portsmouth sand	do	19
Portsmouth sandy loam	do	28
Portsmouth silt loam	do	50
Poygan clay	Glacial Lake	163
Poygan clay loam	do	160
Putnam silt loam	Glacial and Loessial	113
Richland silt loam	do	113
Rio Grande silty clay	River Flood Plain	249
Riverwash	do	251
Rock outcrop	Piedmont	93
Rock outcrop	Coastal Plains	71
Rock outcrop	Glacial and Loessial	128
Rock outcrop	Appalachian	204
Rough broken land	Piedmont	92

Name.	Soil Province.	Page.
Rough broken land	Glacial and Loessial	129
Rough stony land	Piedmont	92
Rough stony land	Coastal Plains	71
Rough stony land	Glacial and Loessial	128
Rough stony land	Limestone	182
Rough stony land	Appalachian	204
Ruston fine sandy loam	Coastal Plains	38
Ruston sand	do	21
Safford silt loam	Glacial and Loessial	115
San Antonio clay loam	Coastal Plains	54
Sanders clay	River Flood Plain	246
Sanders clay loam	do	242
Sanders loam	do	227
Sanders silt loam	do	236
Sandhill	Coastal Plains	70
Sarpy clay loam	River Flood Plain	241
Sarpy fine sandy loam	do	223
Sarpy silt loam	do	236
Sarpy silty clay	do	249
Sarpy loam	do	228
Sassafras fine sand	Coastal Plains	25
Sassafras fine sandy loam	do	37
Sassafras gravelly loam	do	67
Sassafras loam	do	44
Sassafras loamy sand	do	22
Sassafras sand	do	19
Sassafras sandy loam	do	29
Sassafras silt loam	do	49
Saugatuck sand	Glacial Lake	133
Schuylkill fine sandy loam	River Flood Plain	223
Scottsburg silt loam	Glacial and Loessial	115
Scranton fine sandy loam	Coastal Plains	38
Scranton sandy loam	do	32
Scranton silt loam	do	52
Sharkey clay	River Flood Plain	244
Shelby loam	Glacial and Loessial	106
Sioux clay	Glacial Lake	163
Sioux clay loam	do	160
Sioux fine sandy loam	do	146
Sioux gravelly loam	do	154
Sioux gravelly sandy loam	do	143
Sioux loam	do	149
Sioux sand	do	133
Sioux sandy loam	do	139
Sioux silt loam	do	157
Steep broken land	Appalachian	204
Suffield clay	Glacial Lake	163
Suffield loam	do	150
Superior clay	do	162
Superior clay loam	do	161
Superior loam	do	151
Superior sandy loam	do	140
Superior silt loam	do	158
Superior stony loam	do	156
Susquehanna clay	Coastal Plains	50
Susquehanna clay loam	do	54
Susquehanna fine sandy loam	do	35
Susquehanna gravel	do	64
Susquehanna gravelly loam	do	67
Susquehanna loam	do	47
Susquehanna sand	do	21
Susquehanna sandy loam	do	31
Susquehanna silt loam	do	52
Susquehanna stony loam	do	69

Name.	Soil Province.	Page.
Swamp	River Flood Plain	251
Swamp	Glacial Lake	166
Talladega gravelly loam	Appalachian	199
Talladega loam	do	188
Talladega slate loam	do	200
Talladega stony loam	do	202
Teller fine sand	River Flood Plain	212
Teller fine sandy loam	do	222
Tidal marsh	Coastal Plains	70
Tidal marsh	Glacial Lake	167
Tifton sand	Coastal Plains	21
Tifton sandy loam	do	29
Tonowanda loam	Glacial Lake	150
Toxaway fine sandy loam	River Flood Plain	221
Toxaway loam	do	227
Travis gravelly loam	do	230
Trinity clay	do	244
Trinity fine sandy loam	do	223
Trinity loam	do	227
Trinity sandy loam	do	215
Tuscarora sandy loam	Glacial Lake	142
Tyler sandy loam	River Flood Plain	216
Tyler silt loam	do	235
Upshur clay	Appalachian	196
Upshur fine sandy loam	do	186
Upshur loam	do	188
Upshur sandy loam	do	185
Upshur silt loam	do	193
Upshur stony loam	do	201
Upshur stony sandy loam	do	199
Vergennes black clay	Glacial Lake	164
Vergennes clay	do	162
Vergennes fine sand	do	137
Vergennes gravelly loam	do	154
Vergennes loam	do	151
Vergennes sandy loam	do	141
Vergennes stony loam	do	155
Victoria clay	Coastal Plains	59
Victoria fine sandy loam	do	39
Victoria loam	do	46
Volusia clay loam	Glacial and Loessial	117
Volusia gravelly loam	do	123
Volusia loam	do	105
Volusia silt loam	do	112
Volusia stony loam	do	126
Wabash clay	River Flood Plain	245
Wabash clay loam	do	241
Wabash fine sand	do	211
Wabash fine sandy loam	do	218
Wabash loam	do	224
Wabash sandy loam	do	214
Wabash silt loam	do	233
Wabash silty clay	do	249
Wabash silty clay loam	do	243
Walcott sandy loam	Glacial Lake	141
Warners loam	do	153
Washburn loam	do	151
Waukesha loam	Glacial and Loessial	110
Waukesha sand	do	98
Waukesha sandy loam	do	101
Waverly clay	River Flood Plain	245
Waverly clay loam	do	240
Waverly fine sandy loam	do	221
Waverly loam	do	226

Name.	Soil Province.	Page.
Waverly silt loam	River Flood Plain	233
Webb fine sand	Coastal Plains	26
Webb fine sandy loam	do	37
Webb gravelly sandy loam	do	65
Webb loam	do	46
Wethersfield loam	Glacial and Loessial	108
Wheeling fine sand	River Flood Plain	212
Wheeling fine sandy loam	do	223
Wheeling gravelly loam	do	231
Wheeling sandy loam	do	216
Wheeling silt loam	do	237
Wickham clay loam	do	241
Wickham loam	do	229
Wickham sand	do	209
Wickham sandy loam	do	215
Williams loam	Glacial and Loessial	107
Williams stony loam	do	126
Williston gravelly sandy loam	Glacial Lake	143
Williston sandy loam	do	141
Wilson clay	Coastal Plains	59
Wilson clay loam	do	54
Wilson fine sandy loam	do	40
Wilson loam	do	45
Worsham coarse sandy loam	Piedmont	81
Worsham sandy loam	do	81
Yazoo fine sand	River Flood Plain	212
Yazoo fine sandy loam	do	220
Yazoo loam	do	225
Yazoo sandy loam	do	213
York fine sandy loam	Piedmont	81
York loam	do	82
York silt loam	do	83

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SOIL PROVINCES AND AREAS SURVEYED

LEGEND

G — Glacial Lake and River Terraces

Gl L — Glacial Loessial — Glacial and Loessial

Ly — Limestone Valleys and Uplands

Am — Appalachian Mountains and Plateaus

P — Piedmont Plateau

F — River Flood Plains

Ag — Atlantic and Gulf Coastal Plains

12 — Areas Surveyed
For key to Numbers See page 253

BASE MAP FROM U S GEOLOGICAL SURVEY

Scale